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NOTES FOR THE MONTH.

Agricultural Advisory Committee and the Imperial Economic Conference.

At a recent meeting of the Agricultural Advisory Committee for England and Wales, it was agreed that a sub-committee of that body, consisting of Lord Bledisloe, Mr. J. T. McLaren, Mr. R. R. Robbins, Mr. W. R. Smith, and Mr. C. D. Thompson, with power to co-opt two other members representing the Agricultural Committee of the House of Commons, should be appointed to advise the Minister on matters affecting agriculture which may arise at the Imperial Economic Conference to be held in London in the autumn. The committee held its first meeting yesterday, with the Right Hon. Sir Robert Sanders, M.P., Minister of Agriculture, in the chair. The two representatives appointed by the Agricultural Committee of the House of Commons are Captain the Right Hon. E. G. Pretyman, M.P., and Mr. Percy Hurd, M.P.

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The Royal Show at Newcastle.

There is, of course, no place where such a fine display of British cattle is to be seen as at the Royal Show. As an exhibition this year's show was as wonderful as ever. It is true that in some sections the numbers were small, and, as is usually the case, there was considerable variation in merit in the exhibits in some of the classes. As is also usual, however, the general standard of quality was high, and, as always, there were in most sections some cattle of a merit scarcely to be excelled. The standard in this country is a high one, and it is hardly necessary to say that it was in every sense maintained by those who had been appointed for the Show at Newcastle to the distinguished, but often difficult, office of making the awards. Here and there could be seen what a judge would regard as common, though not inferior, but there was also to be noted the perfection of form and grace of outline that are the delight of

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the breeder's eye as well as that of the mere spectator, whose point of view may be far different.

There are many points that strike the observer at any Royal Show, and it is not, of course, the same points that strike all. This year, one feature of the Show was the great display of Shorthorns, including Dairy Shorthorn, and of British Friesians. The counties of Northumberland and Durham are indissolubly associated with the Shorthorn from its earliest history, and visitors to the Show, no doubt, expected to see the famous breed appearing in force in the country of its origin. They did not perhaps expect to see such a show of Friesians, and many of them must have been surprised by the display that was made by this breed. Numerically, the Friesians came next to the Shorthorns, a remarkable testimony to the present popularity of the breed, and, when it is remembered that at the previous Royal Show at Newcastle the breed was not represented at all, it is a no less striking comment on the rapidity with which Friesian cattle have won favour with breeders in this country.

Another feature that attracted attention was the improvement in both Dairy Shorthorns and Friesians in the direction of greater uniformity of type and the dual-purpose character of that type. Improvement in this sense is perhaps a matter on which there may be a wide difference of opinion. To the breeder anxious to possess a cow that is a good milker, but who has to cater for the store cattle market with yearlings that show promise of growing into weighty, well-fleshed steers, it is unquestionable that the type of Dairy Shorthorn exhibited a few years ago left much to be desired. So it was also with many of the early Friesians. Now, in both breeds and among both males and females, there is a noticeable change in conformation, though not yet uniform, which seems to indicate a definite trend towards the breeding of a type of animal, which, having a high milk record, will also prove useful to the grazier. Experience has shown that there is no reason why a cow that is a good milker should not also be a good-looking one. For the ordinary farmer, a general-purpose breed is the most likely to retain favour permanently, and the present tendency in these two breeds, which are singled out for mention here for the simple reason that they were the most numerously represented at the Show, is as interesting as it is significant. Two other breeds, for which a general-utility character has always been claimed, that showed themselves to such advantage as to be remarked upon at the Show were the Lincoln Reds and the Red Polls.

The visitor who attends the Royal Show with the object of seeing the high standard of excellence to which British breeds of cattle have generally attained, found this year, as always, much in all classes, no doubt, to impress him. To the observer of tendencies in the development of breeds, it may perhaps be said that the most striking feature of the cattle section was the direction in which the improvement of two well-known milking breeds is tending and the remarkable uniformity of type which that tendency is producing.

The poultry section at the Royal Show is always good, and was up to its normal standard this year. A new note in recent shows has been the rabbit section, undoubtedly due to the now fashionable use of the finer self-coloured rabbit furs in place of the dyed and treated commoner types sold under various trade names.

A huge collection of agricultural machinery and implements, seeds, fertilisers, buildings and other farm requisites, would provide any farmer with a choice suitable for any conditions or any climate or soil, and formed a most impressive display.

In regard to agricultural and rural education the remoteness of Newcastle from the southern parts of England doubtless led to a much smaller exhibit than usual. In the agricultural education building the Meteorological Office seemed to be very popular with visitors, and indeed it had a good deal to show. The Agricultural Education Association showed how it endeavours to forward agricultural education; and the Fur Board dealt with inquiries in regard to the rabbit fur industry, showing a variety of fur products. The principal space, however, in this section was devoted to the Agricultural Department of Armstrong College, which had a very full exhibit. In one bay were shown various specimens in connection with the management of grass land. Turves cut from the experimental plot at Cockle Park proved a source of great interest to a large percentage of the visitors, and many comments were made on the striking effect of finely-ground mineral phosphates on grass land lying on a poor clay soil.

In a second bay various specimens were shown in connection with animal husbandry, and a set of hides lent by the Newcastle Hides Improvement Society, showing the damage done by warble fly, attracted much attention.

The Cumberland and Westmorland Farm School, Newton Rigg, Penrith, combined with Armstrong College to exhibit examples

of dairy work and matters of general interest in connection with dairying and horticulture.

Other bays contained specimens of crops showing the effect of various plant diseases. The College, in conjunction with the Royal Agricultural Society, provided an exhibit of photographs, prints and paintings showing the development of the various breeds of Northumbrian sheep from about 1780 till the present time. The breeds included the Blackfaced, the Cheviot, the Border Leicester and the various cross-bred sheep in the north. These two bays were in charge of Professor Gilchrist and Alderman Parlour of Darlington.

In a part of the show-ground adjoining the cattle sheds were given a series of clean milk demonstrations of considerable educational value, from the cleaning of an actual cow's udder to the final distribution of the milk.

A word in conclusion might usefully record that the Ministry's own exhibit proved far from unattractive to a large number of visitors. It dealt with clean milk production, silos, model cottages, model cow-houses, etc., seed-testing, harmful weeds, potatoes immune from wart disease, bee-keeping, rat destruction, manuring of grass land at Rothamsted, and pests of farm and garden crops. In addition its publications stand for the sale of this *Journal*, leaflets, and other publications, was kept very busy. * * * * * *

Inheritance of Milk Yield.

IN the issue of this *Journal* for December, 1921, p. 769, reference was made to the results of an investigation carried out at the Maine Agricultural Station with the object of ascertaining the influence of the dairy bull on the milk yield of his daughters. It was shown that, when an analysis was made of the "Advanced Register of Dairy Bulls" maintained by the Jersey Breed Association, the fact emerged that, out of 200 bulls the records of whose daughters were available, approximately one half sired daughters whose records surpassed those of their dams.

The results of a similar investigation in relation to the Holstein-Friesian breed have now been published,* and are worthy of mention, agreeing as they do with the results obtained in regard to the Jerseys. An examination of the Advanced Register of this breed showed that there were 111 Holstein-Friesian sires having two or more daughters with recorded yields. Of these, 65—or roughly one-half—raised the milk

* Maine Agricultural Experimental Station, 37th Ann. Rept., Orono, Maine, 1921, pp. 251 *seq.*

yield of their daughters over that of the dams of these daughters. The list was headed by a bull which on an average raised the milk yield of his daughters by 7,640 lb.; another raised the milk yield of 14 daughters on the average by 4,860 lb.

These figures are independent of any theory: they show clearly how important an influence the sire exercises on the performance of his daughters. They demonstrate, moreover, that pedigree by itself is not a guarantee of performance: pedigree makes performance more likely, and it appears to be an even chance whether a pedigree sire will raise the level of the herd or not. Although the probability that he will maintain it at the same level is greater, still the fact remains that he sometimes lowers it and that the best test of the milking quality of a sire is provided by the records of his progeny. It is, therefore, to be deplored that, for reasons which appear to be peculiar to this country, the prevalent practice is to slaughter the dairy bull before the records of his daughters are available. (A reference to the Swedish practice of keeping bulls until the performance of their progeny is available, is made by Sir Daniel Hall at p. 397.)

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The Growing of Medicinal Herbs.

DURING the past nine months, the Ministry has received numerous requests for information on the growing of medicinal plants; and, in consequence, it was considered desirable to make inquiries, in conjunction with the Ministry of Health, to ascertain if there had been any material alteration in the position of this industry since the previous inquiry in 1916. Following a Conference with the National Health Insurance Commission (England) in that year the Ministry of Agriculture came to the conclusion, reported in the issue of this *Journal* for February, 1917, that there was not sufficient scope in the total quantities required of medicinal plants to justify it in making recommendations which might tend to encourage, or even mislead, a certain class of person into taking up the cultivation of medicinal herbs as a source of livelihood. Leaflet No. 288, which had been issued since 1914, giving particulars of some of the various medicinal plants, was accordingly withdrawn, it being felt that the circulation of such a leaflet would imply that herb growing could be regarded as a remunerative commercial possibility.

The result of the present inquiry shows that the position remains unchanged. It appears that there are abundant sup-

plies of medicinal herbs available at the present time, and that there are no grounds for apprehending any shortage in the future. The supplies are chiefly derived from overseas, and the prices approximate, generally, to those obtaining before the War. In view of the large quantities of low-priced herbs obtainable from abroad, it seems unlikely that the extended production of medicinal herbs in this country would be successful as a commercial undertaking, except, perhaps, on the part of those who have exceptional opportunities for disposing of their products, such as wholesale druggists growing their own herbs; or of those whose production of herbs forms but a small part of their total output of horticultural produce, and who can increase or reduce the areas they devote to herb growing in accordance with market requirements. While some of the medicinal herbs grown in this country are believed to be of superior medicinal quality to those obtained from abroad, the difficulties and expense of collecting small quantities grown in scattered situations, and of properly drying them, would appear to preclude individual small growers from selling their herbs profitably in a limited market already well supplied with foreign produce dried under more favourable climatic conditions.

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Prizes for Well-Cultivated Farms.

A PAPER containing proposals for increasing the average yield of farm crops by a system of farm competitions was read before the International Congress of Agriculture which was held in Paris in May, 1923. The author, Monsieur H. Miserez, of the Belgian Ministry of Agriculture, pointed out that the means by which the present day yield can be increased are already well known and are practised by a number of cultivators. Heavier and more intelligent manuring, the improvement of the physical condition of the soil by suitable cultivation, the use of improved seed, prevention of plant diseases, etc., have produced a steady rise in the average yield of crops during the last forty years. In order to push production to the maximum possible a wide propaganda is necessary, in order to ensure the adoption of the improved methods by all cultivators. For this purpose competitions for farm crops should have as great an influence as has been exerted on animal breeding by live stock shows or competitions. The author suggests that such competitions should be organised on a large scale by local agricultural authorities and by agricultural associations, with the collaboration of agricultural colleges, etc.,

and the assistance of the State. The manner in which they should be organised and the form of assistance by the State or by local authorities would naturally depend upon the conditions of different countries, but some principles of general application are laid down, viz., comparatively large prizes should be offered, which would be open to all farmers in the district cultivating more than a prescribed acreage. A Committee of Judges would visit each farm, to award the prizes and also to give the competitors advice and instruction on the spot. Great publicity should be given to the awards, and the finest crops should be reserved for distribution in the district as seed. The popularisation by this means of improved varieties and strains is regarded by the author as one of the most important results to be aimed at.

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Fertilisers and Feeding Stuffs Act Committee.

THE Minister has appointed a small Departmental Committee to inquire into the operations of the Fertilisers and Feeding Stuffs Act, 1906, to advise whether any, and if so what, amendments are necessary in order to render the execution of the Act more economical and effective, and to report accordingly.

The Committee consists of the following:—

Lord Clinton (Chairman).	Mr. Brian S. Miller.
Mr. E. Richards Bolton, F.I.C., F.C.S.	Mr. George Stubbs, C.B.E., F.I.C.
Mr. E. G. Haygarth Brown.	Dr. J. F. Tocher, D.Sc., F.I.C.
Dr. Charles Crowther, M.A., Ph.D.	Dr. J. A. Voelcker, M.A., Ph.D., F.I.C.
Mr. Thomas Kyle.	

Mr. H. J. Johns, of the Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W., has been appointed Secretary to the Committee.

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Inspection of Potatoes for Planting.

ALL growers of potatoes who may desire to sell any of the crop for planting should bear in mind that the Wart Disease of Potatoes Order of 1923 requires all potatoes sold for planting to be officially certified.

The certificates are of three kinds: (1) that the potatoes have been grown on land believed by the Ministry of Agriculture to be free from Wart Disease; (2) that the crop has been inspected and that on such inspection Wart Disease was not found to exist; and (3) that the potatoes were

inspected whilst growing and were found to be of an approved immune variety, true to type and reasonably free from "rogues."

Certificate (1) can be issued direct from the Ministry in respect of the land in the greater part of England outside the main infected area. In the case of land which is near a known case of Wart Disease inspection of the crop may be necessary, and certificate (2) will be issued if this inspection is satisfactory. Growers of immune varieties should arrange to have their crops inspected so that a certificate (3) may be issued.

Only potatoes with this latter certificate are allowed to be planted in land infected with Wart Disease, and, moreover, it is in the interests of growers generally that the stocks of the immune varieties should be pure and free from "rogues."

The inspection for purity must be made while the crop is still growing, and applications for inspection should be sent to the Ministry as soon as possible, as after the crop has died down the necessary inspection cannot be made.

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The Agricultural Index Number.

OWING mainly to the reductions in the prices of fat sheep and milk, the general index number of the prices of agricultural produce has declined from 54 per cent. above pre-war in May to 51 per cent. above in June. The fall would have been more noticeable but for the fact that British fruit, which was selling at nearly double the pre-war price in June, is now included in the general figure, after being off the market since early in the year. During the last five months prices of agricultural produce generally have been about 10 per cent. below those of the corresponding month of last year.

The following table shows the percentage increase in each month since January, 1920:—

PERCENTAGE INCREASE COMPARED WITH THE AVERAGE OF THE CORRESPONDING MONTH IN 1911–13.

MONTH.	1920.	1921.	1922.	1923.
January	200	183	75	68
February	195	167	79	63
March	189	150	77	59
April	202	149	70	54
May	180	119	71	54
June	175	112	68	51
July	186	112	72	—
August	193	131	67	—
September	202	116	57	—
October	194	86	59	—
November	193	79	62	—
December	184	76	59	—

Wheat and oats realised 1d. per cwt. more than in May, but barley was 3d. per cwt. cheaper. Oats usually appreciate in price during June, and barley prices usually decline whilst wheat remains stationary, so that the index figure of oats was reduced by 1 point whilst those of barley and wheat each advanced by 1 point. Potatoes rose very slightly during June, when there was a rather better demand at some markets for King Edwards, but the rise was relatively less than before the war and the index number declined to 31 per cent. below the pre-war price. Hay was 42 per cent. dearer than in June, 1911-13, and the decline in prices throughout the present year having been normal, the index figure has remained about the same since January.

The average price of fat sheep was 2d. per lb. lower than in May, and 83 per cent. above the pre-war price, a decline of 20 points on the month. Fat sheep are therefore relatively cheaper than in any month since January last and 17 per cent. below June, 1922. The reduction of 2d. per stone in the price of fat cattle as compared with May was relatively much the same as in pre-war years, but the fall of 5d. per stone in the case of fat pigs was relatively greater than before the war. Fat pigs were 69 per cent. dearer than in June, 1911-13, against 72 per cent. dearer in May, whilst fat cattle only declined by 1 point from 53 per cent. to 52 per cent. above pre-war.

Dairy cows were about 10s. per head cheaper than in May, but remained at 50 per cent. above the pre-war price. Store cattle were also cheaper than in May, but store sheep and pigs, though declining in price, were relatively dearer than in the previous month, the fall in June being relatively less than in 1911-13. Whilst store cattle were cheaper than in June, 1922, store sheep and pigs were appreciably dearer than a year earlier.

With the low price of $7\frac{3}{4}$d. per gallon payable for milk sent by producers in excess of their basic quantities, very little surplus milk has been forwarded, so that the average price of milk sold under contract in the London and Birmingham areas shows no change from last month, but owing to a much larger proportion of the milk sent to the Manchester district being sold at 10d. per gallon, the average over all has declined from 63 to 53 per cent. above pre-war; even so, contract milk generally is about 20 per cent. dearer than in June last year. Butter declined by $1\frac{1}{2}$d. per lb. and was only one-third above

the pre-war price, but the decline in cheese was relatively less than in 1911-13, so that the index figure is 2 points higher than last month. Eggs were dearer, but were only 40 per cent. above 1911-13 against 69 per cent. in June of last year.

The following table shows the average increases during recent months in the prices of the principal commodities:—

PERCENTAGE INCREASE AS COMPARED WITH THE AVERAGE PRICES RULING IN THE CORRESPONDING MONTHS OF 1911-13.

	1922.	1923.				
Commodity.	June	Feb.	Mar.	Apr.	May	June
Wheat ...	60	28	27	31	37	38
Barley ...	58	12	8	11	16	17
Oats	57	39	36	39	42	41
Fat cattle ...	71	61	54	51	53	52
Fat sheep ...	121	97	94	100	103	83
Fat pigs ..	82	88	77	71	72	69
Dairy cows ...	64	67	58	55	50	50
Store cattle ...	40	36	31	29	33	31
Store sheep ...	88	100	92	92	98	114
Store pigs ...	97	154	136	131	126	120
Eggs... ...	69	46	55	37	43	40
Poultry ...	116	80	81	75	77	87
Milk	28	90	87	70	63	53
Butter ...	59	72	70	68	40	33
Cheese ...	55	88	95	92	42	44
Potatoes ...	80	—5*	—12*	—28*	—28*	—31*
Hay	35	42	42	40	41	42

* Decrease.

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THE Minister of Agriculture has presented to the House of Commons a Bill to facilitate the confirmation of wages agreements reached by Conciliation Committees.

Conciliation Committees in Agriculture.

The Bill provides that the Minister's powers under the Corn Production Acts (Repeal) Act, 1921, to confirm a rate of wages agreed upon by a Conciliation Committee may, in the case of an agreement made after the passing of the Bill, be exercised on application in writing by a majority of either side of a Committee (instead of as at present only on application by a Committee as a whole).

Section 2 of the Bill provides that a Committee's power to issue a certificate that a contract for the payment of wages to any particular worker at a lower rate than the rate agreed by the Committee is fair and reasonable having regard to the special terms of the contract, shall be extended to enable the Committee to grant such a certificate in respect of all workmen employed on the same special terms in the area.

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AGRICULTURE IN SCANIA.

SIR DANIEL HALL, K.C.B., LL.D., F.R.S.,
Chief Scientific Adviser and Director-General of Intelligence Department, Ministry of Agriculture and Fisheries.

IN June of the current year, Mr. M. W. F. de Wachenfelt, Agricultural Adviser to the Swedish Legation, organised a tour of British agriculturists in southern Sweden and invited the participation of representatives of the leading agricultural organisations in England and Scotland. A party of 15 left London on June 11th and were joined later by Sir Douglas Newton and Mr. German of the National Farmers' Union.

The party travelled by way of Esbjerg and spent their first day in Copenhagen, where they visited the Royal Veterinary and Agricultural School and the Seed Testing Station. The reputation of the College, which was founded as long ago as 1858, is world wide; one was impressed by the completeness of the equipment and the evidence of continued extension, still in progress. The College is situated in Copenhagen itself, and the course of instruction embraces nothing of what would be called in this country "practical work" upon a farm, but the students, of whom there are now over 500, are not admitted unless, in addition to a satisfactory general education, they have had three years' previous experience upon a farm. Thus a high standard of instruction both in agriculture and in the sciences bearing upon it can be maintained. Both here and at Alnarp, the Swedish college that the party visited later, the most notable comparison with British colleges lay in the completeness of the technical equipment for dealing with subjects like agricultural machinery and the industries connected with agriculture, such as dairying and distilling; there was every provision for the fundamental preliminary training of factory managers. The party was entertained to lunch by Dr. Ellinger, the Director, and his staff, and then went on to the Seed Testing Station, where it was received by the Director, Dr. Dorph Petersen.

Copenhagen possesses the oldest seed testing station in the world, and its methods have become classical. Perhaps the most interesting feature is that seed control in Denmark is not enforced by law but is a voluntary control into which all the great seed firms of the country enter. Briefly put, the guarantee given by the seed merchant covers the strain of

seed as well as its purity and germination, and the control takes its own measures to check the guarantees, not necessarily at the instance of the purchaser. The control also regulates the procedure to be followed when a sample proves deficient and compensation has to be paid to the purchaser. To those who know Dr. Dorph Petersen it is unnecessary to insist on the impression he made by his enthusiasm and his kindness.

Farming in Scania.—From Copenhagen the party crossed to Malmö, which became its headquarters during the next three days spent in excursions in Scania, the southern and most highly cultivated province of Sweden.

The country is low, gently undulating, covered with a soil of glacial origin and generally of a light freely-working nature. No hedges are to be seen, woodlands only upon the hills, and the whole country is under the plough. Save for some marshes by the sea the only permanent grass that was seen was one great area of meadow occupying the bed of a reclaimed lake. Except for an occasional boggy patch and pond in an undrainable depression, such as are characteristic of glaciated areas, there was no waste land; cultivation came right up to the roadsides. The other characteristic of the landscape was the high-tension cables that traversed the land, with the occasional towers containing transformers, carrying current to all the farms for light and power purposes from the great water power station at Trolhatten some 400 miles away. The main crops were wheat, barley, oats and rye, the latter to almost as great an extent as the other cereals; sugar beet, with other root crops less prominent; red clover and a grass mixture in which cocksfoot showed up strongly; also a certain proportion of a mixture of peas and barley for fodder purposes. As in all north-west Europe the crops were in need of warmth and sunshine.

The most striking feature was the general uniformity of the farming; not only were all the farmers growing the same crops in the same way, but a high level of cultivation was very evenly maintained. Some districts were better than others as the soil varied, but one did not pass suddenly from a good to a bad farm as is so often the case in England. Very few stock were to be seen in the open; some of the farmers had begun to graze their leys, the milch cows being tethered in a long line so as to advance uniformly over the field, but in a large number of cases the cattle remain indoors throughout the whole year. This naturally involves extensive buildings,

which in the majority of cases were modern, airy, well-lighted structures with the standings for the cows, the bull pens and calf pens under the same roof. All the crops are brought under cover, the barns on the large farms being of vast dimensions. The system of farming is founded upon corn-growing and dairying on the soiling plan, with pigs as the secondary live stock, though not in all cases. Sheep were but little seen. Sugar beet was important within the zones of the sugar factories; in a few instances it was used for distilling. The cattle in Scania were nearly all Swedish Friesians, perhaps a little smaller but not differing essentially in type from the Friesian as we know it. For many years milk recording has been general and breeding and selection have been founded upon the records with the result that a very high average level of performance has been attained, this being regarded as of more importance than record performances of individual cows. But the sort of average results obtained may be judged from the following results in 1921-22. The Alnarp College herd, 153 cows in milk, average yield 9,020 lb., with 3.2 per cent. of butter fat; Baron Ramel's herd, 104 cows in milk, average yield 9,160 lb., 3.25 per cent. butter fat; Mr. Stjernswärd's herd, 91 cows in milk, average yield 10,060 lb., 3.56 per cent. butter fat; Baron Blixen Finecke's herd, 135 cows in milk, average yield 10,250 lb., 3.4 per cent. butter fat; and the Bondesson herd of about 50 cows in milk, average yield 10,800 lb., 3.5 per cent. butter fat. Some of the smaller herds gave remarkable results; for example, a herd of 14 cows only, which in 1921-22 gave an average yield of 17,540 lb. with 3.57 per cent. of butter fat. The other breed prevailing in this part of Sweden, though as a rule associated with the poorer land, was the Swedish Ayrshire, which from an original Scotch stock has been developed to a larger size, coloured almost all over. Again it is being bred mainly upon lines dictated by milk records.

One striking feature was the docility of the bulls; we saw bulls still in use up to 11 years old, a practice which is very helpful in breeding for milk, for the bull is still available when the performance of his progeny can be seen. Again at the Gothenburg show there were classes for groups of cows and a bull, all tied up in a row without partitions.

In connection with cattle breeding, perhaps the most interesting sight was at Simlinge, the centre of a Bull Society founded in 1902. The small farmers who constitute the

society own two bulls, and the members had assembled by the roadside for the party's inspection a selection from their respective herds—the two bulls, and some younger bulls going to the annual sale of pedigree stock at Malmö, cows in milk and heifers, the progeny of the Society's bulls. The cows, all registered, were perhaps a little smaller and shorter in the leg than the show specimens of the breed, but were typical farmers' cows with a very high level of performance. It was a member of this society whose herd gave the remarkable results recorded above.

Many of the larger herds were tubercule free, and very special precautions were taken to avoid infection, some of the owners, for example, would not keep pigs on the same farm.

Pigs were of the large or middle white class, pure bred or crosses of the native breed with large white boars. The bacon factories, of which we saw an example at Trelleborg, insist upon a uniform type for the export market, and this factory issued a monthly leaflet dealing with points of feeding and breeding.

An interesting feature of the farming of Scania is that the system of tenure is not unlike our own. It is not a country of small holdings, and though in some districts small occupier-owner farms predominated, more generally it is a country of large estates, divided into rented farms of varying size, even up to 1,000 acres, held as a rule on lease. The landowners take a leading position in the farming of their estates and in the organisation of co-operative societies, bacon factories and the like. The home farm is generally of considerable size and is farmed on strictly business lines.

Rents, we were told, are about 30s. an acre; wages are about the same as in the north of England and Scotland, equivalent to 36s.-40s. a week but longer hours are worked than in England. On some of the estates there are cottages with about 5 acres of land, the occupiers of which put in two or three days a week as labourers upon the estate. The world's break in prices had caused great farming losses in Sweden as elsewhere, the worst of the depression having been experienced last year. We were told of the perilous position of many men who had bought and stocked farms in the period of exaggerated prosperity towards the close of the war; nor were the sellers much better off for the high prices they had received, because they had invested their money in industrial securities which

had dropped enormously in value and were yielding no income. The sound men were those who had held on their way during the war, neither buying nor selling.

With this brief account of the general impression made by the farming of Scania we may now turn to some points of more specific interest.

The Malmö Agricultural Society.—The Malmö Agricultural Society by which the party was received on its arrival, is typical of the organisations through which much of the work of agricultural improvement is carried on in Sweden. It is a private corporation but the greater part of its income is derived from the State, the Society being the agency employed for the provision of advice to farmers and the organisation of societies for such purposes as milk recording, improvement of live stock, improvement of seed, etc. State loans for such purposes as the building of cottages pass through the hands of the societies, which indeed in a large number of cases fulfil the function, vis-a-vis agriculture, of the Local Authorities in Great Britain. The Society possesses in Malmö a large building with a meeting hall, library, offices and laboratories. The Society owns the adjoining Market Hall where the regular weekly sales of the live stock of the district are held as well as the annual sales of pedigree stock from the milk recording and breeding societies. The Society derives a considerable annual income from its market. The Society's buildings contain veterinary laboratories, the officers of which are partly employed in the control connected with the market, and partly in investigation and the preparation of serums for use in dealing with the various cattle diseases that cause trouble in the district. Here, too, are housed the offices, store rooms, etc., of the Scanian Butter Export Society. All butter passed for export is examined here for packing and weight, the control as regards quality, water content, etc., being exercised by surprise inspections and analyses of the products of the dairies within the control, who alone have the right of putting the State brand upon their produce. The Society employs a staff of advisers who deal with the farmers either as regards general advice on their farming or such specific matters as the control of the herd books and milk records. This method of conducting so much of the work of education and agricultural improvement through the Agricultural Societies is justified as keeping such matters out of the sphere of politics, either local or national, and in the hands of the farmers themselves.

Alnarp Agricultural College.—At Alnarp the party visited the great Agricultural College, one of two in Sweden. It is an extensive institution founded about sixty years ago and includes the Agricultural College proper, the Horticultural College, the Agricultural School, a Dairy School and a School for instruction in Horse Shoeing. The College gives a two-year course of higher instruction of a theoretical character for the training of the larger farmers and estate managers, officials ("agronomes"), etc., and entry is limited to those possessing a sound general education. In the School the course of instruction is shorter and includes practical work for the training of bailiffs and small occupiers. The institution possesses a farm of about 1,200 acres with a herd of some 300 Swedish Friesians, a thoroughly well-managed farm typical of the agriculture of the district, large enough not to have its economy disturbed by subservience to the educational requirements of the College and School. The Dairy School is also engaged in the testing of all forms of dairy machinery and appliances, thus ensuring that the factory manager in course of training becomes acquainted with the most recent forms of machinery.

Winter Schools of Agriculture.—In connection with education we may also mention the Winter Schools of Agriculture of which we saw an example at Hvilan, near Alnarp and another at Fridhem, by Svalöf. To quote from the very excellent descriptive itinerary prepared for the party, "In Scania it is customary for the sons of average farmers, a few years after leaving the primary school to pass through a course at the High School at which instruction is given in general education; and afterwards a course at an Agricultural School, where special agricultural knowledge is acquired. Each course embraces one winter." The school at Svalöf was a handsome building rebuilt in 1920 and it is noteworthy that the whole of the funds required for its erection were obtained by private subscription from the farmers in the district, since the State assistance does not extend to capital but only to maintenance. The building contained classrooms, library, and laboratories on the ground floor, with the hostel above, each student having a room to himself.

Institute for Research in Breeding.—Adjoining the Alnarp Estate is the Institute for Research in Breeding belonging to the University of Lund. Here the party was received by Dr. Nilsson Ehle, so well known for his investigations in the breeding of wheat, of which "Swedish Iron" is an out-

come now well known in England. Dr. Nilsson Ehle gave the party an address on the objects and methods of plant breeding, with special reference to wheat, which was a model of clear exposition, especially considering that he was speaking in an unfamiliar language. This served to elucidate much of the work that was seen both there and later at Svalöf.

The Plant Breeding Station, Svalöf.—Svalöf is probably the feature of Swedish agriculture best known to the world at large; in Great Britain two at least of its products—the "Victory" oat and "Iron" wheat—have spread its fame widely. The Swedish Seed Association began its work on the improvement of farm crops at Svalöf in 1886. Dr. Hjalman Nilsson became Director in 1890 and still holds office. It began with attempts to select the existing varieties of wheat, oats, etc., so as to obtain uniformity and increased yield, by the methods of what we now call "mass selection," such as picking out the largest ears to be found in a field or the best plants in other respects. Thereby little success was obtained beyond a relative uniformity and purity of type. Any old-established variety, say of wheat, even if pure, and commercial varieties even down to recent years were rarely anything like pure, consisting of a mixture of slightly differing strains, all of the same general type but varying in such features as the number of grains the ear will produce, the height and strength of the straw, etc., etc. If one picks out all the long ears some will owe their length to the accident of having obtained a little extra nutriment or water, others—and this will be the smaller number—to some essential quality in their make up which is passed on to the seed arising from them. But in the mixed batch of seed arising from the selection of the long ears, grains will predominate that were derived from ears owing their length to the accident of nutrition and these will not pass on the long-eared character. Consequently the result on sowing will be the reproduction of the original mixed population with relatively few of the true long-eared types, and the improvement of the variety seems as far off as ever.

However, there are real long-eared strains in the mixed population and these can be isolated if instead of sowing the seed from all the long ears together they are grown on as individuals. Then the next year's growth reveals which of them owed their excellence to accident and which to hereditary make up. The best of the latter are saved, again tested as individuals, and eventually a selected one is propagated on a large scale. Thus is initiated a "pure line," the produce of a single individual, which

continues to breed true and carries on the superiority which that individual showed to the bulk of the population from which it was derived. This " pure line " mode of selection was introduced at Svalöf about 1893, and it did result in considerable improvement—complete uniformity of crop and increases in the productivity of the order of 5-10 per cent. above that of the old mixed variety. Still it led to nothing new, for new varieties only arise through cross-breeding.

Cross-breeding, however, seemed to result in nothing but confusion and it was not until about 1900 when the bearing of Mendel's discoveries became generally apparent, that plant breeders were put in possession of a method of picking out the fixed races among the innumerable varieties that arise in two or three generations from a hybrid. Now the technique is established in dealing with self-fertilised plants like the cereals; we know that after the cross the characteristics of the two parents will not be merged but reassorted in every possible combination in the progeny of the second and third generation and that some of these combinations will be " fixed " and incapable of further variation. The desirable ones can be picked out and the " fixed " forms isolated, by the method of pure line breeding from individuals. Thus the production of " new " varieties combining the good points of various individuals has been reduced to a system, and this is the method now followed at Svalöf as at other plant breeding institutions.

The plant breeding institution at Svalöf began as a farmers' association and still derives part of its income from subscriptions. Of its present total income of about £20,000, about £11,800 comes from the State and about £5,000 from the Seed Company which sells the new varieties. The Seed Association possesses the buildings required for its work and about 40 acres for its trial plots, together with 8 subsidiary trial stations in other parts of the country. When it has raised a new variety and tested it sufficiently on its small scale, it hands it over to the Swedish Seed Company, the quantity being then perhaps a couple of hundredweight.

The Swedish Seed Company is a separate organisation, with a capital of over a quarter of a million sterling, which carries on the business of propagating and dealing in the products of the Seed Association. Its divisable profits are limited, the surplus being handed over to the Seed Association for the extension of the investigation and breeding work. It possesses farms of about 2,500 acres adjoining the plant breeding station at

Svalöf, and on these farms, as on the subsidiary stations in other parts of the country, the trials of any new variety are conducted after it has been handed over by the Seed Association. The Seed Association still, however, retains control, and the new variety may not be issued for sale until from the trials on a large scale the Seed Association is satisfied of its value.

The effects of the Svalöf organisation upon the character and quality of the crops grown in Sweden can hardly be exaggerated. It has not displaced the private venture seed firm—indeed, at Messrs. Weibuhll's, near Helsingborg, our party visited a commercial firm employing all the most scientific methods for the production of new varieties of farm crops—but it has set a standard throughout the country, and no farmer purchases a new variety unless its performance can be substantiated by the results of rigorous preliminary trials.

The Bondesson Agricultural Company, Svalöf.—It would be tedious to describe the many farms visited, but it is difficult to pass over the Bondesson Agricultural Company at Svalöf. This is a family company farming a little over 900 acres, but owning also a large butter and cheese factory, which handles about 1,700,000 gallons of milk each year. The separated milk and whey are utilised by a famous herd of large white pigs, the foundation stock of which were obtained in England—whence also regular purchases of boars are still made. The herd is maintained in a vast building alongside the dairy. There were at the time 60 breeding sows, and the progeny, so far as they are not sold for breeding purposes, were being fed for bacon. Altogether there were about 1,500 pigs in this range of buildings and the output of bacon pig amounted to about 6 tons per week.

In another building alongside was the dairy herd of about 115 animals in all, 50 cows in milk. It was pure-bred Swedish Friesian and had a high reputation in the show and saleyards. The average milk production was 1,080 gallons, with 3.5 per cent. of butter fat. This of course was a large capitalist undertaking.

A Successful 150-Acre Farm.—Perhaps a more normal farm equally good in its way was that of Mr. Nils Andersson, a member of the Simlinge Bull Society of which mention has been made above. Altogether Mr. Andersson farms about 150 acres of which he owns 130, and on this area he maintains a herd of Swedish Friesians numbering about 70 in all; he also

breeds horses and makes a speciality of seed cultivation. This is a notable example of intensive farming.

The National Agricultural Show and the Jubilee Exhibition.—The itinerary concluded with a visit to the National Agricultural Show, which was being held this year—after a long interval caused by the War—at Gothenburg, where also the great Jubilee Exhibition was in progress. Naturally the live stock was of most interest to the British party, which had an opportunity of seeing several breeds of cattle of wide distribution in Sweden but not generally kept in Scania. Among these the most notable was the polled race of white cattle with a few black spots, which is the most numerous race throughout the middle and northern parts of Sweden. It is a neat compact animal, bred and selected for its milk-yielding powers in a rough climate and on poor soils.

The Swedes are great horsemen, and horses figured prominently in the show. Blood horses and hunter type horses were very well exhibited, many examples coming from the State stud farms formed to promote the breeding of remounts. The most characteristic utility horse belonged to the Belgian Ardenne breed, largely used for the improvement of the country race, but very striking were the examples of small active Swedish breed with which two batteries of artillery were horsed.

It needs a better live stock man than the writer to discuss the exhibits, but two points seem noteworthy. There were several classes for bulls exhibited with their progeny. Again, judging was carried on by the score card system, and the cards with all the marks were posted up on the pen of each exhibit. Whatever the merits or demerits of judging by the score card one cannot deny the educational value of the posting up of the score card against each exhibit; the judges' opinions were there set out in detail for all to check and many were the discussions we saw in progress.

Finally, one cannot close without recording the extraordinary kindness and hospitality with which the British party was received. We were entertained by the owners of the great estates we visited day by day, by the Board of the Jubilee Exhibition and by the Board of the Agricultural Show at the dinner they gave in honour of the King. This, however, was little in comparison with the warmth of the welcome we received and the manifest desire of our hosts to make the visit both fruitful and pleasant to us.

RED POLL CATTLE.

R. HARVEY MASON.

IN the Eastern Counties and probably elsewhere there are many poll cattle highly esteemed for grazing and some for milk among the tenant farmers. Many are red, but many more are variable in colour, looking chiefly like shorthorns without horns, though some probably have slugs and may have been with shorthorn or half red bulls.

It was out of this stock that pedigree Red Polls were selected many years ago. The blood-red colour was held in the highest favour, and many farmers in Suffolk and Norfolk were found early in the last century to have herds entirely red and to have been careful to breed from red bulls.

It was Mr. Henry F. Euren, the editor of the *Norfolk Mercury*, who in 1874 with the help of friends who were breeders of Red Polls in Norfolk and Suffolk and were keen about them, published the first volume of the herd book and registered as many Red Polls as he and his friends found up to a standard description. He did this until the Red Poll Society was formed. There were 44 breeders in Norfolk and Suffolk at that time who subscribed to this work, and among them was an ardent American, Mr. G. F. Tabor, of Ravenwood Farm, Patterson County, New York, U.S.A., who afterwards imported a good many of these cattle.

Mr. Euren called the cattle Red Polled, but this name was altered in 1909 by the Red Poll Society which did not admit that any herd ever had horns which had been polled. That society was established in 1888 and purchased the copyright of the books previously published from Mr. Euren.

There is no record of any Red Polls kept in any other counties in Great Britain at the time when pedigrees began, but Mr. Euren discovered that there was an old breed of these cattle in a remote part of Austria and that Prince Terchenstein in 1869 purchased animals from Lord Sondes, who then had a herd at Elmham in Norfolk, to infuse fresh blood into his herd of native bred cattle.

In Arthur Young's survey of Suffolk we find that Red Polls existed there in 1792, and previously to that in "The Suffolk Traveller," John Kirby of Wickham Market refers to the butter they produced being the pleasantest and best in England. Arthur Young found the cattle were spread over the whole county and were sometimes crossed with shorthorns, but he does not recommend this with a view to the dairy. In those days very

little if any attempt was made to improve the breed, until the agricultural societies were established and premiums were offered for Suffolk cattle pure bred, *i.e.*, by a Suffolk bull out of a Suffolk polled cow. Whether this plan should be established was discussed at a meeting at which the Earl of Stradbroke presided. It was pointed out that Norfolk also bred Norfolk cows generally called "home breds" and that pure red was its distinctive colour. Although there were polled cattle of various colours both in Norfolk and Suffolk, the Red was always held in best estimation as long ago as 1782. Mr. Marshall, agent of Lord Suffield, Gunton Estate, in the "Rural Survey of Norfolk" says:—

> "The native cattle of Norfolk are a small, hardy, thriving race; fatting as freely, and finishing as highly, at three years old, as cattle in general do at four or five. .... the head, in general, fine, ... the favourite colour, a blood red, with a white or a mottled face .... These two qualifications; namely, the superior quality of their flesh and their fatting freely at an early age .... The medium weight of a well-fatted three year old is forty stone (of fourteen pounds each).
>
> Bulls of the Suffolk polled breed have, ... been brought into this District: and there are several instances of the Norfolk breed being crossed with these bulls. The consequence is, an increase of size, and an improvement of form: but it is much to be feared, that the native hardiness of the Norfolk breed, and their quality of fatting quickly, at an early age, are injured by this innovation ....
>
> The fact appears evidently to be, that the Norfolk husbandmen are in possession of a breed of cattle, admirably adapted to their soil, climature, and system of management: and let them cross with caution."

The principal breeders in the early part of last century were in Norfolk: Mr. Reeve, of Wighton, Mr. England, of Binham, and Mr. George, of Eaton. These men co-operated to improve the native polled cattle by careful selection, and some of their stock were shown at the Holkham sheep shearing, and attracted much attention. At Mr. Reeve's sale in 1828 the advertisement reads "Eleven matchless blood-red cows in calf, two three-year-old heifers in calf, eleven two-year-old heifers in calf, and a two-year-old blood-red bull, one of the most perfect animals in the Kingdom." Mr. George is said to have bought a cow costing 25 guineas, which at the time was thought to be a very high price. His cattle were sold to go to several places both in Norfolk and Suffolk.

There is no doubt that the establishment of separate classes for Norfolk Poll Cattle at the agricultural shows in that county which were amalgamated into one in 1846, gave great impetus to the improvement of this stock.

Photo.] [*Sports and General.*

FIG. 1. Red Poll Bull, Marham Florin : prize-winner at the Royal Show, 1923.

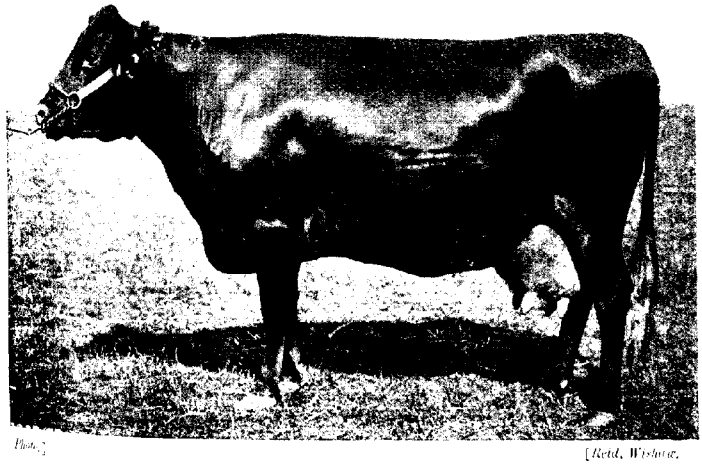

Photo.] [*Reid, Wisbech.*

FIG. 2. Red Poll Cow, 18051 Frill P3.

FIG. 3. Group of Red Poll Cows, owned by Mr. R. Harvey Mason.

At the British Association Meeting at Norwich in 1868 Mr. Clare Sewell Read said:—

> "We have to commemorate a grand revival of the Polled Norfolks as a numerous and distinct breed. The old fashioned gay home breds are not recognised the true stamp of the improved Norfolks, for the latter are a blood-red and while slugs and horns are studiously avoided, and their milking properties well cared for, they possess a uniformity of character, style and make that would do credit to many of our established breeds."

Red Polls are recognised to be a smaller breed than Shorthorns, Friesians, South Devons or Herefords. An average cow's height is 4 ft. 2 in. and girth 6 ft. 6 in. In a grazier's yard 5 can be kept for 4 of the other breeds, some say 4 for 3. They are docile and feed quietly, whereas horned cattle are sometimes troublesome. The beef is of the same value as that of the Aberdeen Angus and cost of feeding is proportionate to the number which can be kept, as quoted above.

A good many Red Polls were exported to the United States from 1882 to 1888 and an American Society was established there. Several of the members were impressed by the value to them of hornless cattle, as horned ones damage horses and other cattle at the drinking places, and as the poll type predominates in cross herds they found a good market for bulls to use for crossing purposes, as the horns disappear.

Milk.—The Red Poll is distinctly a dual purpose animal, producing the best beef and rich milk. The milk yield varies from 5,000 to 12,000 lb. in a year, and owing to milk recording, a good trade for high grade milkers (which at first did not exist), and the breeding from bulls bred from prize-winning cows at dairy shows, milk records are fast improving. The butter fat testings show 3.5 to 4.1 per cent. of butter fat, and even up to 5 per cent. in some cases.

Up to about 1890 the principal trade was for exhibition and export. Americans north and south wanted fine meat and extra good looks, and consequently breeding followed those lines, little attention being paid to milk. This began to alter soon after the Chicago exhibition in which there were prizes for good milkers, and some buyers came over to select a few specially good milking cows which were to give at least 4 per cent. of butter fat. These men showed the farmers how they should buy cows. They went to the early and late milkings and each time brought a Babcock Tester, and tested the milk. This was long before milk recording was carried on as it is now.

Beef.—Red Polls have been always noted for the prime quality of the beef they produce. Graziers have generally obtained 1s. or 2s. a stone more than butchers will give for larger breeds. At the present time there is considerable inquiry for small joints, and Red Poll steers sell well both as stores and finished meat. At a Smithfield Club show weights as follows were recorded :—

	years	months	days	weight cwt.	qr.	lb.
Red Poll Steers under 3 years	1	4	4	11	3	27
	2	10	16	15	2	26
	2	10	18	16	2	23
Heifers under 3 years	2	10	14	15	3	9
Steer " 2 "	1	10	3	11	3	27
	1	9	8	12		

Description.—The following is the standard description of the breed :—

Characteristics and Form.—

Colour :—Blood-red ; deep red for preference ; tip of tail and udder may be white.

Head :—Must be poll, *i.e.* not artificially polled and without horn, slugs or abortive horns.

Nose :—White.

Hips :—Evenly rounded ; not prominent.

In all other particulars the commonly accepted points of a superior animal to be taken as applying to Red Poll cattle.

Objections.—

Any extension of white in front of the udder.

Any white on a bull except on tip of tail.

A cloudy or dark nose.

Disqualifications.—

Any horns, slugs or abortive horns.

Any signs of artificial polling.

A black or blue nose.

Any white except on the tip of the tail, the udder, or for a short way under the body.

Any colour other than red.

In the first herd book the herds were divided geographically into groups and these groups were subdivided into tribes, certain cows being selected as foundresses of the tribe. This plan has been found very useful for breeders. This book contains only 38 breeders, all from Norfolk and Suffolk. Since that time the members of the society have increased gradually and it now includes 449 spread over a large part of England, Wales and Scotland, and a few in Ireland. Exports have recently gone to

France, Norway, Sweden, South Africa, Rhodesia, Argentina, Brazil, Uruguay, Australia and New Zealand.

The number of registered Red Poll cattle is 5,661, including bulls and cows. Many have passed into the hands of wealthy men. In fact, the value of the herd has been so high that only wealthy buyers have been able to obtain the best animals. Members of the society are still increasing and as there are herds that include very few cattle it may be expected that the future sales will be well attended.

General.—Cattle that have flourished on the poor pastures of East Anglia will go on to much better land, and it may be expected that owing to the careful selections that have been made, to the use of only the best bulls, and to the finer pastures on which they will feed, great improvements in the breed may be expected before long. The best way to improve is to scrap the worst and keep the very best cows and heifers to breed from. The shows and sales promoted by the society will enable breeders to do this. Formerly, until these sales were started, one might wait some time for customers to come along and then naturally they wanted the pick, and if such were continually sold, the herd would go back and require time to recuperate.

In Norfolk and part of Suffolk the pastures are not good as compared with the midlands and west of England. Moreover, the parks are usually well timbered and consequently flies are a great torment to cattle. The larger breeds have seldom obtained any great success in consequence of this in those counties, but Red Polls do quite well. Their habit in warm weather is to feed and also to stand in clumps together, and their tails whisk the flies off one another.

At the agricultural shows Red Polls are increasing in numbers, and their quality is distinctly better than ever. His Majesty the King is patron of the society and is a successful exhibitor, and one may hope that before long he may breed a champion bull and cow.

The colour of a herd of Red Polls is very attractive on the green background of a well wooded park, and if there is any drawback at all it may be that, when they are a well matched breed rather than a collection of various types, it is difficult to distinguish one cow from another except by the ear marks. After all, the herdsmen always know them well and can help the owner out of any mistakes. These men get very proud of the animals of which they have the care, become fairly good

judges of them, and can help in the selection of such as are worth exhibiting. They are generally capable of remembering something of the pedigrees and if there is a distinction between sires to use they do not and should not make any mistakes. A good milker can often advise about the udders of cows when there is a difference in the way they milk, and they take readily to the work of recording the weights of milk and entering them on the weekly sheet.

It is advisable to have all one's calves trained to be led and tied up, as it makes them more docile afterwards, and less inclined to get wild when turned out to grass, and finally as heifers come to be served or sent to sales and cows to be tied up for milking. Bulls of course require rather more training to lead than females. Comparatively few males are worth keeping for pure breeding in this country, but in America, Africa, Australia or other countries that have inferior native cattle almost all bulls can be sold at remunerative prices for cross breeding, with the result of immense improvement in the cross breed.

Milk recording has not been carried out long enough for generalisation on particular matters.

Red Poll Cattle Societies in the Colonies and Abroad.—

Australia.—President, the Hon. T. H. Payne, M.L.C., Wordburn, Kilmore, Victoria.
Vice-President, Colonel Arnold Caddy, Chandpara, Tylden, R.S.O., Victoria.

New Zealand.—Norman Inder, Secretary, New Zealand Cattle Breeders' Association, Kotare, Matatera.

South Africa.—J. Fraser, Secretary, Box 250, Bloemfontein.

Canada.—P. J. Hoffman, Secretary, Aannaheim, Saskatchewan.

United States America.—W. A. Martin, Richland Center, Wisconsin, U.S.A.

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SHEEP SCAB: ITS PREVENTION AND REMEDY.

REPRESENTATIONS have been made to the Ministry during the past year by agricultural bodies representative of a considerable body of opinion amongst sheep owners, in favour of more drastic measures with a view to the eradication of sheep scab. The position of the country with regard to sheep scab is not satisfactory. The number of outbreaks reported by Local Authorities during the past four years is as follows:—

Year	*England*	*Wales*	*Scotland*	*Total*
1919	245 ...	69 ...	124 ...	438
1920	240 ...	107 ...	129 ...	476
1921	368 ...	206 ...	183 ...	757
1922	284 ...	246 ...	153 ...	683
1923 (to 30th June)	158 ...	139 ...	47 ...	344

It will be observed that although there has been a slight improvement since the close of the year 1921, the number of outbreaks still continues large, particularly in Wales and the Highlands of Scotland.

One of the principal difficulties in securing the eradication of scab is the general carelessness and apathy displayed by many sheep owners in carrying out the Sheep Scab Orders and dipping operations, and the reluctance which still apparently exists to accept double dipping (that is, two dippings in a sheep dip approved by the Ministry with an interval of not less than 7 and not more than 14 days between them) as the effective method of preventing and curing scab.

In view of the strong and growing feeling amongst agriculturists throughout the country in favour of a more determined attempt being made to eradicate this disease, the Ministry has, during the past few months, given publicity to a proposal to throw the onus of curing and preventing scab upon each owner of sheep, and has received expressions of opinion in favour of such a policy from many agricultural bodies and Local Authorities.

An Order has accordingly been made which will give effect to this proposal by directly requiring sheep owners to take such steps from time to time as are reasonably practicable to secure that their sheep are free from sheep scab. The Order further provides that occupiers of farms or holdings upon which sheep are kept, and owners of sheep kept on common land, shall be liable in case of failure to take such steps as above-mentioned, to the penalties prescribed by the Diseases of Animals Acts, viz., to a fine of £20, or if the offence is in respect of more than four sheep, to a fine of £5 for each animal, or in certain cases, to imprisonment. It is an important provision in the Order that in the case of proceedings instituted thereunder on or after 1st July, 1924, in any case where sheep scab is found, the burden of proving that the Order has been complied with will rest upon the person charged and not upon the prosecutor.

A pamphlet has been issued by the Ministry containing full information as to the measures which it is advisable to take in connection with sheep scab.*

The effective method of curing or preventing sheep scab is double-dipping, that is dipping twice with an interval of not less than 7 and not more than 14 days between the two dippings, provided that the dip used is one that has been approved by the Ministry, and care is taken to see that the dipping is thoroughly carried out in accordance with the instructions on the label. Unless the dipping is properly done scab can never be eradicated.

When dipping to comply with Orders of the Ministry or Regulations of the Local Authority, it is of the utmost importance to remember that:—

(1) The dip used must be one that has been approved by the Ministry. There are a large number of effective dips for scab, non-poisonous as well as poisonous, which have been so approved and the responsibility in selecting an approved dip rests with sheep owners;

(2) The dipping bath must be mixed in the proportions specified as approved by the Ministry. It is inadvisable to make up a dipping bath by mixing two or more dips together, as this may result in neutralising the effect of both dips to scab, and may in some cases be injurious to the sheep;

(3) The directions and precautions indicated by the manufacturer on the label must be strictly observed;

(4) The sheep must be kept immersed in the bath for the period mentioned on the label. Special attention should be paid to the heads, necks, and tails;

(5) During the dipping operations proportionate quantities of dip and water must be added to keep the bath up to the proper strength; it is best to mix these *before* they are added to the bath;

(6) After each lot of sheep has been dipped and before the bath is re-mixed the dipping bath should be carefully cleaned out, the residue being disposed of in such a manner that it cannot injure animals or pollute streams. A satisfactory method is to run the residue from the bath into a trench or pit, the sides and bottom of which have been plentifully sprinkled with lime, so that the liquid from the bath runs through the lime before passing into the soil. This is

* Copies of the pamphlet can be obtained free of charge from the police or from the offices of the Ministry or the local authority.

specially important when poisonous dips are used in order to avoid risk of injury to sheep through accumulation of poisonous matter. Under no circumstances, however, should the lime be added to the liquid while it is still in the bath;

(7) If an arsenical dip is used for the first dipping it is advisable to use a non-poisonous dip at full strength for the second dipping, but if arsenical dips are used for both dippings, the second dipping should be at half the strength of the first dipping.

Persons using poisonous dips must take the precautions necessary for the avoidance of accidents or injury to sheep through the use of such dips, and the Ministry will not entertain any claim for compensation for injury or loss due to their use. The choice of an approved dip rests entirely with the user. The responsibility for the class of ingredients is a matter for the manufacturer of the dip. The approval of the Ministry only means that the ingredients of a dip are effective for scab in the proportions approved.

The new Order* does not supersede, but is an addition to, the existing Sheep Scab Order of 1920, which prescribes the procedure to be followed in connection with individual outbreaks of sheep scab, and requires all persons having under their charge any sheep affected with, or suspected of, sheep scab, to give notice of the fact immediately to the police.

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CARNATIONS.

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THE carnation has for many years been grown in large quantities by market gardeners for the sale of the cut blooms. Formerly these were obtained from the classes known as Border Carnations and Malmaisons, which produced blooms in abundance during the summer months only, and though in recent years the season for these has been somewhat lengthened by various cultural methods and a better selection of varieties, they fail to produce blooms over a period sufficient to meet the ever-increasing demand for the carnation. These Border Carnations and Malmaisons, though still cultivated to some extent, have been superseded by the class known as Tree or Perpetual Flowering Carnations. This type or class, when

* Single copies can be obtained from the Offices of the Ministry, 10 Whitehall Place, S.W.1., free of charge.

grown under glass, produces practically the whole year rou... choice blooms with long stems, which keep fresh for extend... periods. These flowers are much in demand during all mont... of the year, and the commercial carnation industry has reach... important dimensions.

This branch of flower growing during the past few years has increased in size and has become highly specialised. Mo... glass-houses are being planted annually to carnations, so that the competition in markets is becoming keener each season, and should markets become overloaded with bloom, only th... who are growing carnations exceptionally well are likely t... succeed. The industry is not one for the novice to take up. It requires special training to acquire the necessary skill and manipulation, and it is an advantage to have a general experience in growing plants under glass.

Propagation.—The young plants are propagated from cuttings taken from the older plants, and much can be done to ensure healthy plants by taking the cuttings only from plants specially marked either for extra colour in the bloom, for general health and vigour of the plants, or for productiveness. In this way the standard stock of any variety may be retained or may even be improved.

The cuttings are obtained by cutting or pulling off the side shoots from the stems, just below where the blooms are cut, in such a manner that a shoot from 3 to 4 in. is obtained with a heel, though this latter is not absolutely necessary. In making the cutting it may be necessary to remove 2 or 3 pairs of the small leaves, though in the case of longer jointed shoots it may only be necessary to remove one pair—this to secure a clean stem to insert in the propagating medium. The months from November to February are the best for propagation, though it may be carried out almost at any time provided the right class of cutting can be secured. Carnation cuttings root very freely if given the right conditions.

The cuttings must not be allowed to flag before being inserted in the propagating bed, which is composed of pure sand 2 in. in depth, and made quite firm. It is convenient to have the cuttings at intervals of 2 in. in rows 3 to 4 in. apart according to the size of the cuttings.

After insertion, one good watering in should be given and the lights closed, and if necessary shaded for a few days from strong sun, but rarely is it necessary to shade during the winter

growths. The pit which contains the propagating bed should be supplied with bottom heat of from 55°-60° F., the higher temperature being the maximum to which it is safe to go. The pit will require occasional ventilation and watering.

In two or three weeks' time the roots will appear, and as these develop, additional air may be admitted stage by stage until the young plants will stand the lights being entirely removed without flagging. The cuttings are now ready for potting and no time should be lost in getting the rooted cuttings planted in pots of size 60 in a fairly good loam made porous by the addition of sand, brick rubbish, or ballast. After this stage the compost should be free working but not too rich.

The pots should be placed on benches or stages in a glass-house kept at about the same temperature and as near as possible the same atmospheric conditions as the propagating house. Light overhead spraying should be given for a few days, and water supplied at the roots when the general condition of the soil seems to warrant it. The temperature of the house meanwhile should not exceed (by fire heat) 50° F. As soon as the young plants have passed the danger from flagging and this will be as soon as the roots have spread in the fresh soil air may be admitted. If the atmosphere of the house and general conditions are correct, no shading will be necessary unless propagation has been delayed till quite late in the season. As growth proceeds and the plants develop, more room will be needed and some spacing must be arranged.

Stopping.—It is usual during the early stages of growth and whilst the plants are in 60 pots, to resort to "stopping" to induce the plants to throw out side growths. This is done by removing the growing point down to about the fourth pair of leaves. Some good growers favour the removal only of the appearing flower spike. The former practice gives a bushy plant, but if the latter procedure is practised the side growths appear higher up on the stem. After this "stopping" has been done the plants should grow into sturdy bushy little plants ready for planting out (*a*) into larger pots, or (*b*) into prepared beds in the carnation house.

Re-potting into 48s'.—If the former method of culture in pots is favoured then the plants must be re-potted into 48s' in good loamy soil to which 10 per cent. of well-rotted manure and ½ per cent. of fine bone meal have been added. Generally the young plants should be ready from about the 1st of March

onward for transferring into 48s', where they may remain for about two months.

Re-potting into Flowering Pots.—As they become ready they should be finally re-potted into pots of size 24 in soil a little richer than that advised for 48s'. It is an advantage to use soil as coarse as can be conveniently placed between the ball of the plant and the side of the pot without damaging the former. Firm potting is essential. The stem of the plant should not be buried too low, or stem rot may become a source of trouble.

It is the common practice to stand the plants out of doors from about the 1st of June to September, re-housing them just before they come into bloom; but whilst this practice gives economy of labour and housing, it does not produce blooms as fine as those from plants that have been kept under glass and protected from adverse weather conditions. The carnation plants under glass must be given all the air possible and must be watered, not heavily but generously, while on all really hot days the atmosphere of the houses must be kept as cool as possible by frequent damping of the floor, stages, etc. Feeding with manure should not be necessary until well on in the summer.

Planting out in Beds.—Though considerable success may be attained by cultivating and flowering the plants in pots, this method is now very largely superseded by growing the plants in prepared beds of soil in large and well-ventilated glass-houses.

Where beds have to be made up, large quantities of soil are not necessary, 4 to 6 in. of compost being sufficient to carry the plants 2 or 3 years, with an occasional light top dressing of soil and artificial manure.

Good maiden loam enriched with well-rotted manure and some bone meal (say, 1 per cent.) is about the best compost, though it should be of a fairly porous nature, as any tendency towards sourness during the winter months is detrimental. This soil should be raised some few inches above the ground by means of bricks, tiles, clinkers, or anything else of a porous nature to provide good drainage and aeration.

The plants from 60s' should be put in beds during April, and treated as advised for pots. If there is likely to be some delay in preparing the beds the plants should be re-potted into 54s' or even into 48s', but there appears to be a distinct advantage to be gained by early planting.

When planting, the ball of soil should be kept as near the surface as possible without actually exposing it, and above all, the planting must be *firm*.

The young plants must be watered carefully until they have their roots well established throughout the whole bulk of soil, when the supply may be more generous. Similar care with ventilation is necessary for the first week or two after planting; but once the young plants have become established, practically full ventilation can be given until September, by which time the flower buds will be showing, the nights will become colder and the atmosphere damper, so that a different line of treatment will be necessary.

With the first cold spell in September, fire heat will be necessary, so as to maintain a fairly dry and buoyant atmosphere. A high temperature is not necessary and must be avoided, so that fire heat can and should be dispensed with whenever possible. In dry weather the temperature can be kept from 46° to 50° F. with just a little fire heat, though on the other hand it may be advisable to fire with the glass outside at, say, 50° F. or even higher to secure the proper atmospheric conditions inside the house.

Disbudding.—Practically all carnations are now sold on single stems, *i.e.*, without any of the secondary buds being left on, so that as the flower stem advances all side buds must be removed; the proper stage to do this is when such buds can be removed readily with the downward movement of one finger, if attempted too early it is quite a tiresome operation and many of the centre buds are liable to be damaged or broken.

Some varieties, such as White Wonder, at certain seasons of the year are apt to give flat or deformed buds, and growers must look out for this. If the disbudding is performed too early it may mean that only the centre and deformed bud is left, but experience should soon teach the grower with which varieties and at what season trouble is likely to occur, and at such times the disbudding should be left till it can be seen that the centre bud is perfect—if not, it must be removed and one of the side buds allowed to develop in its place. On the other hand, in ordinary circumstances disbudding must not be left too long or it will result in the loss of size in the bloom.

Pests.—In common with all other plants the perpetual carnation is subject to various pests, both fungoid and insect, and to keep them as free as possible, all details of cultivation must

be carefully observed and carried out at the proper season, but with every care occasional sprayings and fumigations will be necessary to keep the plants clean.

Varieties.—When selecting varieties for market purposes due consideration must be given to the requirements of the particular markets that are to be served.

In the case of sales direct to the consumer or to the smaller florists the choice of varieties is not of such paramount importance, and many more varieties may be grown and sold at a profit in this way than when sending to a large market, which usually wants a bulk of good standard varieties and chiefly self colours, such as Pink, Salmon Pink, Cerise, White, Scarlet, and Crimson, with a very much smaller percentage of Yellow, Mauve and Fancy varieties.

It is impossible to state exactly what are the best varieties to suit all soils and situations; varieties that do well in one soil or locality may not succeed to the same extent in another, possibly only a few miles away, but the following list is a selection of the best in the various colours:—

Pink.
- Mayday
- Mrs. Walter Hemus
- Enchantress Supreme

Salmon Pink.
- Lady Northcliffe
- Bona
- Cupid
- Laddie

Scarlet.
- Aviator
- Tarzan
- Beacon
- Edward Allwood

White.
- White Wonder
- Wivelsfield White
- White Mayday.

Crimson.
- Triumph
- Carola
- Nigger

Cerise.
- Peerless
- Mrs. C. W. Ward
- Rosette

Mauve.
- Mikado
- Eastern Maid
- Wivelsfield Claret

Fancies.
- Wivelsfield Beauty
- Benora
- Jazz
- Wivelsfield Apricot
- Circe
- Bishton Wonder

Yellow.
- Saffron
- Maine Sunshine.

Marketing the Bloom.—The flowers should be cut before they are fully developed, and probably the best time to do this is in the early morning. The gathered blooms are taken to the packing shed and placed in deep tins containing clean water. Next comes the process of grading, and this is done by women and girls who sort out the blooms in best and

second grades, quickly returning them to the water where they remain till packed for the market. The graded blooms are packed in special wooden boxes, 3 ft. long × 8 to 9 in. broad and 4½ in. deep, lined with tissue paper. The number of blooms packed in each box varies according to the grade and the season of the year—2, 3 or 4 dozen is the usual quantity for the best grades, while the seconds or worst grades are often packed in bunches each of 12 blooms. The blooms are held in position with a cross stick.

A label showing the quantity of blooms and the grade should be attached to the end of the box to enable the salesmen and buyer to judge as to the contents without opening the box, thus facilitating trading and distribution. The blooms are needed for their beauty, and it is important to remember that this may become wholly or partially destroyed through faulty packing.

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AGRICULTURE AS A CAREER FOR BOYS

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AGRICULTURE as a career offers many attractions. It presents many possibilities and many problems which must be carefully considered before any venture is made. To be successful the farmer must not only be well educated, but also essentially practical, being capable of taking his place in the daily routine of farm work, showing the labourers he can work, and means to do so, and expects them to do likewise. Wide experience, sound judgment, careful training, a good education, and businesslike methods are essential to the modern farmer.

Agriculture opens up a variety of careers. In Great Britain farming may take the form of general farming, or general farming with some specializing in certain breeds of live stock or varieties of crops—or definitely specialized farming, such as dairy farming, pig rearing, fruit and vegetable growing, poultry farming, etc. Abroad, the same general division of the types of farming holds, but the specialized type is of frequent occurrence, *e.g.*: tea planting, cattle rearing, sheep farming, etc. Throughout the Empire there is vast scope. South Africa,

Rhodesia, Australia, and New Zealand demand that the prospective farmer shall possess adequate capital. Canada makes no specific stipulation. Representatives of the Dominions will readily supply full information.

For the development and organisation of the manifold activities of such a great industry as agriculture, officials are appointed by the Ministry of Agriculture, and by the county and similar authorities. Research workers are required for the large mass of important research that awaits them at such Experimental Stations as Rothamsted, the Universities, Agricultural Colleges, as well as at private laboratories.

Large and progressive commercial firms, such as "Company Farming" enterprises, seed merchants, firms who make feeding stuffs and artificial manures, textile firms, agricultural engineers, etc., have their staffs of experts, and are generous to really good men who can combine theory with practice in a fruitful way to the elucidation of the many problems that present themselves in this kind of work. Capable men can look to appointments, under Government or otherwise, both at home and abroad.

Finally, there is the demand for able lecturers in Universities, Colleges and Schools.

General Education.—It should be clearly understood that a good general education is just as essential for the boy who proposes to be a farmer as for any other boy, because a broad education will make him a better farmer and a better man. In successful farming a sum equal to 100 per cent. of the capital invested may be turned over in a year. This may mean a turn-over of many thousands, and success demands a man of education at the head of affairs. It also demands a man of real knowledge, which is not merely book knowledge, but practical experience, coupled with scientific training. There is no substitute for practical experience. School and college may prepare the way for more enlightened, more progressive, more successful work, by the farmer or by the agricultural scientist, but to each of them practical experience is essential, and this experience is not obtainable except "by the sweat of the brow." Unfortunately, this fact is frequently misinterpreted as a reason for neglecting the general education, for the premature withdrawal of a boy from school, or for specializing in agricultural subjects at too early an age.

It is agreed then, that the boy must be well educated. At school he should certainly learn science, with engineering and

woodwork if possible. During his school days—say till 16 to 18 years of age—the future agriculturist should have been spending much of his holidays on farms. If the boy has been at a school where agriculture has been well taught, he is now in a position to make a start in life by commencing as a farm pupil. But such schools are not common, so the boy should, in most cases, go to a Farm Institute or an Agricultural College, or the Agricultural Department of a University for a sound course of instruction. If the boy intends to do this, he should arrange to pass any necessary examination before leaving school, and at such a time as will enable him first of all to spend at least twelve months working on a farm.

Agricultural Education.—No one doubts the value of agricultural education. It enables the agriculturist to move with the times, it broadens his views, and it provides that valuable knowledge of the fundamental principles upon which agriculture rests. There is too much loss occasioned by the time-lag between the liberation of new knowledge and its application. There is too much hesitation in trying new ideas, and too little ability to profit by the object lessons provided by others. Agricultural education prepares the way for progress. The scientific man opens the book of knowledge. It is for the farmer to read and to learn and to profit the world and himself by the knowledge. A scheme of education that provides nothing better than "half-baked scientist farmers" is not agricultural education, nor does it advance the cause of agriculture.

There is no lack of opportunity of obtaining agricultural education throughout the country, and for convenience of description, the types of agricultural education available will be described under four headings: (1) College or University, (2) Farm Institutes, (3) Local Courses, (4) Schools with Agricultural Departments.

1. *College or University.*—Gives a course of 2, 3 or 4 years to men who intend to become landowners, occupiers or managers of large farms, land agents, lecturers, officials, etc.

The colleges demand a sound preliminary general and scientific education.

For details, apply to the Ministry for a copy of Leaflet No. 197.

2. *The Farm Institute.*—This is intended for the instruction of sons of smaller farmers, bailiffs, etc., who cannot leave the farm for the whole of the year, but can take short courses of instruction in the winter months. The course provides fundamental technical instruction, which will put those following the

course in touch with modern methods of farming. It also enables them to take advantage of information and advice provided by the Ministry, by books, and by the technical press. For details apply to the Ministry for Form 732/T.E. and Leaflet No. 197.

3. *Local Courses.*—These aim at bringing instruction to workers on the land by means of evening or day classes, lectures, demonstrations, or manual instruction classes in the various skilled operations of the farm. Courses in agriculture, dairying, veterinary hygiene, horticulture, fruit growing, poultry keeping, instruction in agricultural processes (hedging, ditching, ploughing, etc.) are usually provided free or at a nominal charge by County Agricultural Committees or similar Local Authorities. Details are obtainable on application to the Agricultural Organiser or to the Secretary, at the Office of the County Council.

4. *Schools with Agricultural Departments.*—There are a few Schools in the country which, besides giving a good general education, provide for considerable specialization in agricultural subjects. These schools vary in character, and more exact information may be obtained by application to the Headmaster or Principal of the school or to the Board of Education.

The following schools specialise, more or less, in agricultural subjects :—

1. Dauntsey Agricultural School, West Lavington, Wiltshire.
2. Sexey's School, Blackford, Wedmore, Somerset.
3. Brewood Grammar School, Staffordshire.
4. North Eastern County School, Barnard Castle, Durham.

Free Agricultural Education—Scholarship Scheme.—Exceptional opportunities are provided for boys and girls who intend to take up an agricultural or allied pursuit. Scholarships are offered by the majority of County Councils, which enable suitable students to attend courses at University Departments of Agriculture, Agricultural Colleges and Farm Institutes. These scholarships are awarded to residents in the respective counties, and particulars may be obtained by application to the County Council concerned.

Scholarships are also offered by the Ministry of Agriculture and Fisheries, but the beneficiaries under this scheme are limited to the sons and daughters of agricultural and rural workers. The scholarships are of three types :—*Class I* scholarships enable students to attend degree and post-graduate diploma courses at Agricultural Departments of Universities, or, in the case of veterinary science, at the Royal Veterinary College, London;

Class II scholarships enable students to attend a two-years' course in agriculture, dairying, horticulture, or poultry-keeping, at University Departments of Agriculture and Agricultural Colleges: *Class III* scholarships enable students to attend courses of one year's duration or less in agriculture, horticulture, poultry-keeping or dairying, and are tenable, for the most part, at Farm Institutes. Under the scheme, 10 scholarships each of Classes I and II and from 100 to 150 of Class III may be awarded by the Ministry each year. Further particulars can be obtained on application to the Ministry.

Practical Training and Experience.—No one should think of starting to farm on his own account until he has had practical experience for at least two or three years after leaving school or college. He must learn not only to plough, harrow, mow, reap, hedge and ditch, and perform every other agricultural operation or process, but also to determine just when these operations will achieve the best results. He must learn to manage the live stock of a farm. In all probability this experience is best obtained on a good mixed farm—not too large—where he works as a farm labourer would, and where he gives a hand with everything. After this stage a knowledge of farm managing and marketing is needed, and for this purpose, he should try to go as a pupil on a rather larger farm, under a sound practical man who is willing to take the pupil about with him round the farm, and to market, and explain his methods. It must be remembered, too, that only a few of those farmers whose characters, abilities and business methods are outstanding, have either the inclination or capacity to impart the knowledge they possess. The selection, by the parent, of the farmer who will guide the boy is all-important, and in this matter the County Agricultural Organiser may be in a position to offer valuable advice. Big premiums do not necessarily buy valuable experience, though it can seldom be obtained without being well paid for.

Finally, before starting to farm, the future farmer should endeavour to obtain experience for at least two years, in a responsible position, in the actual kind of farming he proposes to take up, and preferably in the part of the country where he is going to farm. Soil, climate, markets, local practices, etc., vary a great deal, and the knowledge of the relation between these factors and the mode of farming is essential before success can be achieved. The premiums required by farmers and others to take pupils also vary. In a few cases

a farmer is willing to take a pupil, more or less as a return for the work done by him, but as a rule the farmer requires an adequate premium, and also demands that the pupil shall be a worker, and mean business. A pupil who finds his own lodgings may have to pay any sum from £50 to £150 per annum, the amount varying, of course, with the circumstances of the pupilage. If the pupil lives in the farmer's house, the amount may vary from £100 to £250. It should be remembered, however, that this apprenticeship is a most important part of the boy's training, and that the thing that really matters is for the boy to receive the sound preparation so vital to the success of his future career.

Prospects: Capital.—It must be set down at the outset that, at the time of writing, the prospects of farming are none too rosy, and that the question of capital is all-important.

A farmer who knows his business, and is not unduly hampered by lack of capital or unfavourable conditions, will be able to make a living, provided that he is prepared to work hard for long hours, practically every day of the year. There are light and heavy seasons, but if he is of the right sort, he will get his recreation out of his farming. If, however, he is so constituted as to require a comparatively high standard of living and leisure apart from his farm, he had better take up some other occupation.

It is quite impossible to speak with certainty on the prospects of farming, or to give any definite figures as to the capital required. So much depends upon the fluctuating conditions of the day and on the personal factor. Agriculture is passing through a difficult period, and what the future holds nobody can say.

Some parents who are considering farming as a career for their sons are fully aware of every aspect of the financial side of the business, but there are others who do not possess this knowledge, and for their benefit the following generalisation and figures are presented, which, however, must be read with all caution and accepted as a rough guide for the present time only.

Small farms are severely handicapped by high capitalisations and heavy expenditure, particularly in rent, rates and labour, together with certain difficulties in marketing.

In the last year or so profits have been made on farms which are almost entirely grass and have maintained dairy rather than grazing herds. Those that are half arable and half grass

have little more than held their own, while heavy losses were, in many cases, made on arable farms. These results have been largely affected by the drop in values, which has occurred during the last two years. (In 1922 it may be specially noted that not only was the price of corn poor, but the yield also.) However, labour and commodities which the farmer has to buy are becoming cheaper—facts which help to counteract the effect of low prices.

The capital required to take a farm is about £15 an acre for ordinary farming, or, calculated on a different basis, the capital required is at least ten times the rent for ordinary farming, and more for specialized farming. In a few instances, as in the case of large farms and chalk farms, the figures may be somewhat less than those given above, but generally speaking, it will be dangerous not to assume these figures as the minima. The capital required will vary to a very appreciable extent with the locality, the type of farming, and other circumstances. The fact that there must be ample capital at the back of the prospective farmer cannot be too strongly emphasised—to start farming with insufficient capital is to court failure.

There is little to be gained by training a boy without access to capital, for large scale farming. There are as yet comparatively few openings in Great Britain, for a clever boy without money to get a footing in the business of farming by beginning in a lowly paid post, and developing into a manager. Such a boy may possibly become an official or expert, but he stands little chance of becoming a farmer on his own. However, he can go abroad into the colonies and do well.

Starting the Career.—In choosing a farm, and in dealing with the difficulties which will inevitably arise when he starts on his own, a young farmer should obtain, if possible, the advice of a really good, trustworthy, practical farmer in the district. The struggle will be his own, and he must face it, but good advice should always be sought and followed when it is available.

The candidate for research, organizing, teaching, and expert posts, may be safely left in the hands of University and College Authorities. The good, keen man will always be noted.

Branches of Practical Agriculture other than Farming.—There are several careers nearly allied to that of farming, in which a livelihood can be obtained from the land, such as market gardening, fruit and flower growing, nursery gardening, etc. As in the case of farming, knowledge, experience, energy, business capacity, and other qualities are essential to success,

and special consideration must be given to markets, situation, soil, climate, labour, and other factors, before a holding is decided upon. The capital outlay is very variable, and it must be remembered that in the specialized industries mentioned the capital required per acre tends to be higher—however, the acreage required is often relatively small. It is well known that many have found in this kind of work a congenial and remunerative mode of life.

* * * * * *

SAINFOIN.

SAINFOIN (*Onobrychis sativa*) is a leguminous forage plant, which is believed to be truly indigenous on chalk and limestone soils in the South and South-east of England. The common cultivated variety is said to have been introduced from France about the middle of the 17th century.

The plant has pinnate leaves and racemes of pink flowers on long stalks. The fruit is a single-seeded pod, easily recognised by the net-veined markings on the surface. The seed is bean-shaped and about three times as large as red clover seed.

Varieties and Their Uses.—There are two varieties in commerce, viz.: (1) Common Sainfoin, (2) Giant Sainfoin.

Common Sainfoin is a slightly smaller and much longer-lived plant than the giant variety, and is often used in temporary and permanent pasture mixtures on soils which are fairly rich in lime.

As a rotation crop, common sainfoin may be cut for hay and the aftermath grazed for sheep. As a sheep food the young herbage of sainfoin compares very favourably with that of any other forage crop, more especially for finishing off sheep for market.

It generally attains a height of about two feet and flowers normally in late May or during June. Common sainfoin is usually at its best about the third year; but under suitable conditions it may be allowed to stand for 5, 7 or even 10 years.

Giant Sainfoin was introduced from France, and there are records of its being grown near Baldock (Herts) as early as 1832. It is shorter lived and more luxuriant in growth than common sainfoin and can give two cuts of hay during the year; hence it is suitable for rotation cropping. It is not usually

Plate I.—SAINFOIN (*Onobrychis sativa*, Lam.).

Seeds in Sainfoin Samples, all × 3.

1. Sainfoin, unmilled.
2. ,, milled.
3. Burnet (*Poterium Sanguisorba*, Linn.).
4. Cleavers (hooks rubbed off) (*Galium Aparine*, Linn.).
5. Dock sp. (*Rumex* sp.).
6. Barren Brome (*Bromus sterilis*, Linn.).
7. Field Brome (*Bromus arvensis*, Linn.).

left down for more than two seasons. It is a useful alternative crop to clover on those soils in the south and south-eastern counties of England where it can be grown successfully.*

Soil and Climate.—Although sainfoin seems to prefer light soils containing a considerable percentage of lime, it is adaptable to a much wider range of conditions than is generally believed to be the case. Good crops are grown both on clays and loams in districts where the climate is dry and warm. Under suitable conditions the primary root descends to a great depth, and the plant is able to withstand the severest drought, being almost independent of surface moisture. Stagnant water, however, is fatal to the success of the crop. On the poorer and lighter classes of soil, sainfoin contributes very materially to the success of subsequent crops. Barley, for instance, follows it with great advantage and on thin, dry soils unsuitable for turnips, rape and mustard may often be successfully grown after sainfoin.

Preparing the Seed-Bed.—The cultural conditions best suited to the growth of sainfoin are practically the same as for lucerne.† The soil should be clean and in good heart, the sub-soil well-drained and readily penetrable by the tap-root.

Seed and Method of Sowing.—The seed of commerce may be obtained in the husk (unmilled) or with the husk removed (milled). The use for seed purposes of milled sainfoin has advantages over the use of sainfoin in husk. In some districts there may be a prejudice against the use of milled seed, the opinion being held that stocks of the old common sainfoin are more likely to be genuine if obtained in the husk. There does not, however, nowadays appear to be any grounds for this belief. Evidence that has accumulated at the Official Seed Testing Station shows that higher purity and germination will usually be obtained from milled than unmilled seed.

The purity of sainfoin in husk is on the average one or two per cent. lower than that of milled seed. Moreover, the nature of the impurity is different. It is difficult entirely to eliminate brome grass, burnet or similar large seeds from unmilled sainfoin, whereas the impurity in the milled seed consists usually of broken fragments of seed.

Unmilled sainfoin always contains a small proportion of husks which are either entirely empty or which contain partially

* Sainfoin is believed not to be susceptible to Stem Eelworm. It is susceptible, especially the first year, to Clover Stem Rot, and occasionally is attacked severely. *See* Leaflets No. 46, *Stem Eelworm*, and No. 271. *Clover Stem Rot.*

† *See* Leaflet No. 160, *The Cultivation of Lucerne.*

developed seeds. These would be eliminated by milling. Also a healthy seed may have great difficulty in breaking through the husk and may die in the process. It will be clear, therefore, that, other things being equal, a milled sample of seed will have a higher germination than the same sample in husk.

The milled seed has a smooth surface, is kidney-shaped, and in good samples is plump and yellowish-grey or light brown in colour outside and of a greenish tint inside. When black or shrivelled it has been spoilt either by bad harvesting or old age, and perhaps by a combination of both. Only fresh coloured seed should be sown and all old or discoloured seed discarded.*

The seed is drilled in 7 in. to 12 in. rows, at right angles to the corn or other cover crop from February to May a little deeper than clover seed. The land should be in good heart and for this reason is often in corn after a root crop fed off with sheep. The corn crop should be sown thinly (about $1\frac{1}{2}$ bushels per acre) with a corn drill, and in spring-sown corn the sainfoin may be sown immediately after with the same corn drill. In this case the drills will be approximately 7 in. wide, with the result that subsequent intercultivation will not be quite so easy as with a slightly wider drill. When the corn or cover crop has been sown in the autumn, there might be more difficulty in getting a sufficiently good tilth in spring for the sainfoin, and in such cases it is often advisable to use a disc drill, so as to get the seed in sufficiently deep to be properly covered. In the case of common sainfoin, which is intended to occupy the ground for a number of years, the soil should be free from weeds and it may even be advisable in some cases to sow this variety without a covering crop. Four bushels of unmilled seed or 56 lb. of milled seed per acre is the customary rate of sowing. It is usual to grow sainfoin pure in the Eastern Counties, but on chalk or limestone in the South and West of England it is often used as a constituent of a mixture for temporary or permanent leys. A mixture of giant sainfoin, red clover and Italian rye grass makes excellent hay.

Manuring.—When practicable a dressing of very short dung, *i.e.*, thoroughly rotted to destroy weeds, given during the first autumn, helps the plant in the early stages, and is, moreover, a protection against frost. This should be followed in the spring

* As regards the provisions of the Seeds Act, 1920, and the Seeds Regulations, 1920, and also as to the facilities offered to farmers by the Official Seed Testing Station, Huntingdon Road, Cambridge, *see* Form No. 728/C S., obtainable from the Ministry.

with a dressing of 2 to 3 cwt. of superphosphate and 2 to 3 cwt. of kainit per acre.

If the sainfoin continues to be cut for hay the above dressing of superphosphate and kainit should, generally speaking, be continued each year, although a further dressing of farmyard manure would be useful after an interval of three or four years.

Cutting the Crop for Hay.—*It is important that cutting for hay should start directly flowering commences*, as the plant is then at its best for feeding purposes, and each day's delay impairs both the quality of the hay and the future yield of the plant. It should be handled with great care, like lucerne and clover, to avoid breaking off the fine leaf; but it is not readily spoiled, if left unturned, even in wet weather. A yield of 30 to 40 cwt. of hay per acre is considered an average crop. In the case of giant sainfoin two crops of hay are often mown the first year after sowing, while seed is generally taken from the second crop in the second year, before ploughing up. Common sainfoin is usually cut for seed in its last year, before ploughing up, but a seed crop may be taken in any year except the year after sowing. When allowed to ripen for seed, cutting takes place in July or August, as soon as the lower seeds are fully ripe, and the crop is carefully dried before being stacked. In order to prevent shedding of mature seed, it is desirable to cut the seed crop either early in the morning or late in the afternoon, when the plants are not too dry. In a good season 25 to 30 bushels of seed in the husk may be obtained per acre.

If it be intended to keep the crop down for several years, it is usual to cut sainfoin for hay in the first year in order to encourage deep rooting; afterwards it may be mown or grazed as circumstances require. Whether as hay or as green forage it is an admirable food for all fattening and breeding stock, and is regarded as the best possible change for stock which may not be thriving on ordinary pastures.

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THREE NEW DISEASES OF THE HOP.

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IN the following article, three fungous diseases of the hop, new to this country, are described. The first disease, the "Downy Mildew," is an introduction from Japan or from America, and its potentiality as a dangerous disease may be

gauged from the fact that the fungus is included amongst those legislated against in the "Destructive Insects and Pests Order of 1922." The second disease, the "Leaf-spot," causes a "spotting" of the hop-leaf, and has, so far, not been observed to cause any serious injury; the fungus concerned was found to be a species of *Cercospora* new to science. The third disease, to which the name "Hop-drop" has been given, is associated with the presence of a minute fungus (*Macrosporium*) which attacks the stalk of the cone, "eating" it through and causing the cone to fall to the ground.

1. **Downy Mildew** (*Pseudoperonospora Humuli* (Miyabe and Takah.) Wils.).—In October, 1920, when examining, in the experimental hop-garden at Wye College, a number of seedling hops raised from seed of the "wild hop" (*Humulus Lupulus* L.) obtained from Italy, we noticed that on some of the plants the leaves were spotted in an unusual manner, the characteristic feature of the spots being their angular outline. The spots were dark brown above and paler on the under-surface of the leaf. When the lower surface of the leaf was examined with a lens, a blackish-grey "mould" was visible on the discoloured areas, and under the microscope the "mould" revealed itself as composed of the branched fructifications of a "Downy Mildew" (*Peronosporaceae*). At the tip of the branches fruit-bodies (*sporangia*) were borne; each of these, placed in a drop of water, produced in the course of 2 or 3 hours a number of actively motile *spores* (*zoospores*) which swam about in the water until finally they settled down and began to germinate by putting out a short germ-tube. When this took place on a hop-leaf, the germ-tube entered the leaf, formed a *mycelium* within it, and gave rise after a few days to the fruiting-stage of the fungus.

Although a search was made for the fungus on the same plants and elsewhere in the experimental hop-garden in 1921 (a very dry season), it could not be found, but early in September, 1922 (a very wet season), it reappeared, both on the leaves of a considerable number of seedling hop-plants of various origin, and on the hop-cones of several of the plants. On the leaf the disease was again characterised by the angular outline of the spots (*Fig.* 1). On the hop-cone, the bracteoles were attacked first, and this gave the hops in many cases a striped appearance, the vertical rows of dark brown bracteoles (which withered under the attack) alternating with the bracts which were still green (*Fig.* 2). Later in the same year (October) another form of fructification of the fungus was found, viz., resting spores

(*oospores*)—rounded bodies, thick-walled and measuring 28-34 μ in diam.—formed by the spawn (*mycelium*) of the fungus in the substance of the leaves just below the lower epidermis. These resting-spores falling to the ground with the leaves would remain alive until the following season and germinating then, would thus perpetuate the disease from year to year.

When the disease was found again in 1922, and both forms of its fructification obtained, it was suspected to be the species of "Downy Mildew" described in 1905 as occurring on the hop in Japan, and named *Peronoplasmopara Humuli* by Miyabe and Takahashi.* This supposition was found to be correct when, later, we were able to examine authentic specimens of the fungus from Japan sent to us by Prof. Kingo Miyabe.

Since the present disease is one of which hopgrowers in this country have had no experience, it will be of interest to give here an account of the disease as it has been observed in other countries. The following extract* relates to its original discovery in Japan: "It was in the early summer of 1905 that our attention was first drawn to a diseased appearance of the leaves of the cultivated hop-vines in the experimental plot of the Hokkaido Agricultural Experiment Station in Sapporo. An examination showed at once that it was due to a kind of 'downy mildew.' . . . In the hop-field belonging to the Sapporo Brewery Company a careful search was made on June 15 this year (1905), and we found the mildew to have already begun to spread to an alarming extent throughout the field. A portion of the field adjoining the place where the hop-vines were collected and burnt the previous autumn was very badly attacked. The lower leaves of the vine [bine] were at that time most infected, but the disease had already spread to some of the upper leaves. Judging from the extent to which the fungus had spread in the field, we may safely infer that the disease had existed there for many years without drawing attention. Messrs. S. Fujita and J. Kasaharae, of the Company, struck with the seriousness of the case at once took active measures to combat the disease. By thoroughly spraying with Bordeaux mixture and by systematic picking of the affected leaves, they were able to prevent the spread of the disease for the rest of the year."

The fungus has been found also in Japan on the wild hop, *Humulus Lupulus* var. *cordifolius*, indigenous to that country, and Prof. K. Miyabe remarks (*l.c.*): "These facts prove beyond

* *K. Miyabe* and *Y. Takahashi;* in *Trans. Sapporo Nat. Hist. Soc.*, I. part 2. (1905–6).

Fig. 1.—Hop Leaf showing the Angular Spots caused by the Downy Mildew (*Pseudoperonospora Humuli*) (Nat. size).

Fig. 2.—Hop-cones attacked by Downy Mildew: the bracteoles are attacked before the bracts, so that the discoloration often appears in vertical stripes as seen in the middle cone (Nat. size).

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FIG. 3. -Hop leaf attacked by the "Leaf-spot" disease caused by *Cercospora cantuariensis* (Nat. size).

FIG. 4.—Hop-cones showing the stage in the "Hop-drop" disease when a brown, discoloured mark is seen near the middle of the stalk; later the hops become detached at that point and fall (Nat. size).

doubt that the mildew is indigenous to this country growing on the wild hop-vine, and has recently found a more congenial host in the cultivated hop-vines introduced from America and Europe."

In a letter received recently from Prof. Miyabe, the following additional information is given: "The mildew attacks the cones of the cultivated hop, making them quite worthless. I have found the fungus on *Humulus japonicus* too."

In 1909 a "downy mildew" was observed* by Dr. J. J. Davis on the "wild hop," in the State of Wisconsin, in North America. In a letter sent to us in 1921, Dr. Davis writes that he met with the fungus (which he has identified as the same species *Pseudoperonospora Humuli*) described from Japan) again in the previous summer in the north-eastern part of the State, and adds: "I do not doubt that it is indigenous."

The manner of introduction of the "downy mildew" of the hop into this country is unknown. Roots and seeds of the wild hop of Japan (*H. Lupulus* var. *cordifolius*) were obtained in 1917 from Japan and planted in the experimental hop garden at Wye College, but the "downy mildew" carefully searched for each season since 1920, has never been found on plants of this origin. If the fungus is indigenous to the United States, as has been asserted, there exists the possibility that the downy mildew has been introduced into this country on hop plants obtained from America.

There is also the possibility that the garden plant, *Humulus japonicus*, which is grown not infrequently in England as an ornamental climbing plant, has been the means of introducing the fungus on imported seeds.

It is much to be feared that in wet seasons the "downy mildew" of the hop may prove a dangerous enemy. On the first appearance of it on the hop plant, the affected leaves should be picked off *and taken away from the hop garden and burned*; the whole plant should then be well sprayed with Bordeaux mixture.

Any outbreak of the "downy mildew" of the hop should be at once reported to the Ministry of Agriculture.

2. **Hop Leaf-Spot.**—A disease, in the form of spots or blotches on the leaves, was noticed in September, 1922, in a

* Dr. J. J. Davis, "A New Hop Mildew" (*Science*, n.s., Vol. XXXI, 752 (1910)).

hop-garden, of the Canterbury Golding variety, near Canterbury. The spot caused by the disease was circular in general outline (*Fig.* 3), with a greyish (almost white) central portion, $\frac{1}{8}$ to $\frac{1}{4}$ in. diameter, bordered by a dark, purplish-brown line, outside which was a yellowish zone which gradually merged into the general green of the healthy parts. Where the spots were close together on the leaf the yellow zones coalesced to form large yellow areas. These colour characters were more conspicuous on the upper surface of the leaf than on the lower. With a pocket magnifying glass hair-like outgrowths were visible projecting from the lower surface of the spots. Under the microscope these were found to be the *spores* of a fungus belonging to the genus *Cercospora*; each spore was cylindrical, with tapering ends, pale brown in colour and divided by cross-walls into a variable number, 5 to 14, of cells. The size of the *spore* is variable: the length is usually 200μ or more, and the width about 14μ.

Although no appreciable damage was observed to be caused to the hop plants on which this disease occurred, it appears desirable to record this new enemy of the hop, as other species of *Cercospora* are capable of causing very serious injury to the plants on which they occur.

3. **Hop-Drop.**—A disease, for which the name "hop-drop" is proposed, was met with in September, 1922, in a hop-garden near Canterbury. The disease manifested itself by causing a considerable number of the hop-cones to fall to the ground shortly before the hops in the gardens concerned were ready for picking. The varieties of hops affected were Cobbs and Canterbury Golding. An examination of the hop-plants showed some of the cones hanging loosely on brown stalks ready to fall, and others with various amounts of browning on the stalks, the first stage of the disease being evident as a brown discoloration on the stalk at about half an inch below the hop (*Fig.* 4).

A fungus was invariably present on the brown portions, bearing *spores* on short stalks; these *spores* were broad and rounded below, and narrowed towards the apex, pale brown in colour and divided into a number of cells by several transverse walls and usually also by a few longitudinal walls; they measured 23-67 × 10-15μ.

The constant association of the fungus (*Macrosporium* sp.) with the brown discoloration on the stalks suggests that it is the

*The species proved to be new to Science, and has been named by us *Cercospora cantuariensis* (see *Journal of Botany*, Vol. 61, 134 (1923)).

cause of the trouble, but confirmation by inoculation experiments has not yet been possible. It seems probable that this fungus belongs to that class of parasites which are able to attack plants only when the latter are in a state of "physiological weakness." A condition likely to have been produced in the hop-plants in question by the cold and wet weather, accompanied by gales of wind, that occurred during early September last year.

Although in the above case the quantity of hop-cones which fell to the ground before picking-time and were lost was inconsiderable, the disquieting effect on the mind of the farmer was considerable on seeing a portion of a crop on which several hundreds of pounds had been spent, falling to the ground and being wasted.

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PERMANENT ALLOTMENTS: "SECURITY OF TENURE" AND HOW TO OBTAIN IT.

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THE one thing which is uppermost in the mind of most allotment holders is security of tenure. It is difficult to see how any allotment holder can be expected to produce the best possible results of which he may justly feel proud if he has the constant fear in his mind that one day, either now or in the near or distant future, his land will be taken from him for building or other purposes. This fear must be prejudicial to the cultivation of an allotment, and in this connection it should be remembered that an allotment provides a man with a form of recreation and undoubtedly tends, to a far greater extent than is generally supposed, to keep his mind and spare time occupied; it consequently helps to make him a contented citizen and thereby adds to the ordered state of the community of which we in England are able to boast to-day.

This being so, the following particulars of the work of the Addiscombe and Woodside Allotments Society (1921) Limited, Croydon, may prove helpful and interesting to other Societies who are now occupying land for allotments, either on lease direct from private owners, from a local authority who have

hired the land, or in any other manner under which they are faced with the prospect of losing their ground when required for building or other purposes.

The Addiscombe and Woodside Society is believed to be the first society in the kingdom to acquire, with the assistance of the local authority, its own freehold. The executive of the Addiscombe Society decided at the end of 1920, when the society was still a war allotment society and as such not a registered society, that arrangements should be put in hand for finding a permanent home for their members when the war plots came to be given up.

It was obvious to the executive that all the grounds, about 8 in number, held at that time under D.O.R.A., and ranging from one acre to 12 acres in extent, would undoubtedly be developed as building land as soon as conditions became more normal. It was decided, therefore, to make a survey of the neighbourhood, and, if possible, concentrate on some ground, which, while actually not building land in the full sense of the term, would nevertheless be situate fairly centrally in the district, and thus be accessible for members of the society living in all parts of the district.

It should be explained here that Addiscombe, a part of Croydon, was before the War, and still is, being rapidly developed by the erection of middle-class houses. It was realised, therefore, that any ground which was in any way accessible in the district, would command a good price.

As a result of the survey, it was decided to focus attention on two fields of about 35 acres in extent, in the occupation of a local farmer. The extreme end of the ground—about 7 acres—was very wooded, and therefore unsuitable for allotment purposes. The next step was to approach the Local Authority, viz., the Corporation of Croydon, and urge that negotiations be started with the ultimate view of the society obtaining the freehold of the remaining 28 acres. How this was to come about was not clear to anyone at that time. In Croydon, however, allotment holders are fortunate in having a very sympathetic Small Holdings and Allotments Committee on the Council. This being so, negotiations were opened, but after a period of three months the society was notified by the Council that the price asked was prohibitive, and the figure named would have prevented the Society letting the plots at a reasonably low rent. The executive of the society further

considered the matter and decided that whatever obstacles were in the way must, if possible, be removed. The ground decided on was the only suitable ground in the district and it was felt that every effort should be made to obtain it. At the same time the executive realised that it would not be possible to pay the high price demanded for the land. The Council were again approached, and correspondence was reopened with the owners. As a result of protracted negotiations the price was eventually substantially reduced. Even at this figure, however, after adding the necessary overhead and management charges of a society, it was considered that the plots could not be let at a reasonable rent.

One side of the ground had a frontage to a lane leading from one of the main roads in the district. This lane was marked out under the town planning scheme for a 50-ft. roadway, and negotiations were under way for development of the estate by a local builder. As a result of a conference between the writer and the Borough Engineer, it was decided to offer the frontage of the proposed allotment ground to the builder at a reasonable figure. This was eventually agreed to with the result that 3½ acres were taken from the 28 acres, leaving the society with 24½ acres at a cost which would enable it to let plots at 1s. 3d. per rod, which was considered a reasonable figure. The society thereupon decided to register under the Industrial and Provident Societies Acts and thus be in a position to issue shares to its members and thereby provide the deposit on the purchase price. Shares of the nominal value of 5s. each were issued and all members were expected to take up a minimum of £2 worth of shares. As soon as the formalities of registration were completed, the Council were informed, and they in turn approached the Ministry of Health for consent to a loan to the society under the Small Holdings and Allotments Act, 1908. This was eventually sanctioned.

By a resolution of the Small Holdings and Allotments Committee of the Croydon Corporation the Corporation decided to advance 80 per cent. of the purchase price of the land, on mortgage to a properly constituted and registered society, the society to find the balance of 20 per cent. It was decided, therefore, by the executive of the society, to raise a share capital of £600 by means of 5s. shares to provide this 20 per cent. The shares were accordingly issued and when sufficient had been taken up to provide the 20 per cent., the money was paid over to the Croydon Corporation. Although negotiations for the

purchase of the land were commenced as far back as December, 1920, it was not until the end of December, 1922, that the society actually entered into possession. No member has so far been allowed to become a plotholder without first becoming a shareholder.

At the Annual General Meeting of the Society held on the 1st December, 1922, draft regulations were submitted and approved which laid down very clearly how the new ground was to be controlled by the society. Under these regulations—a copy of which was later supplied to each plotholder as he took over his plot—members were allowed to erect on their plots tool sheds of a uniform size, and these had to be erected as shown on the society's plan, on the right-hand back corner of each plot, 18 inches from any pathway. By this means, the two sheds would be back to back. It would be possible to wheel a barrow down the pathways between the plots, and the sheds when erected would give an appearance of uniformity which was essential for a well-ordered society.

Another regulation gives the General Secretary power to call on each member for at least one hour's work per month for the purpose of keeping the society's property in good order and doing any other work necessary for the good of the society.

In order to be in a position to let plots at a rent which compares favourably with other allotments in the neighbourhood this regulation is absolutely essential. Where a society owns its own freehold it is quite impossible to consider paying for all labour required for general services, such as erection of fencing, cutting of trees, etc. In fact, instead of letting the plots at 12s. 6d. per 10-rod plot per year, the Local Authority in making their calculations, were unable in the first instance to see how they could be let at a lower rent than 18s. 6d. per plot if the Local Authority had to provide all the fencing and carry out other necessary works. It can only be done where the necessary organisation exists for meeting the difficulty and where "co-operation is the watchword" as in this society. In fact, without co-operation among all members of any allotment society, it is difficult to see how the best results can be obtained.

Before the plots were allocated all members were asked to state on a form (*a*) how much ground they required, (*b*) whether they were desirous of having their plot next to or near to a friend or friends, and (*c*) what form of assistance they would be willing to give to the General Secretary for the purpose of general requirements on the ground.

The allocation of the plots was in the hands of a sub-committee, who allotted plots on the basis that the further a man lived away from the ground, the nearer he should be to the entrance to the ground.

The sub-committee arranged at the same time to group members together as far as possible in accordance with their wishes as expressed in (*b*) on the form, and as a result practically all plotholders were satisfied with their decisions.

Obviously, in taking over ordinary pasture land for allotments—much the same as moving into an empty house—many things needed attention. The brook running through the centre of the ground and dividing the two fields had to be bridged in two places. For this purpose, the society purchased a quantity of railway sleepers and the necessary work was carried out by the plotholders. In addition, it was necessary to erect a cattle-proof fence, 810 ft. long, across the ground in order to cut off the wooded portion which had not been purchased. This work was also carried out by the members, at a cost of about $\frac{1}{3}$th of the estimate of the Local Authority, which estimate, of course, included the cost of labour—a very big item in these days.

The executive of the society decided that in order to meet their liabilities it would be necessary to charge 1s. 3d. per rod, *i.e.*, 12s. 6d. for a 10-rod plot. In addition to this, under the rules of the society, each member has to pay a yearly subscription of 1s. per member, irrespective of the amount of ground held by him.

It should be mentioned that the society have a very strong social side, for the beneficial results of which the executive are indebted to a committee, including women, who manage the whole of the catering and decorating part of the work. Whist drives, dances, concerts, etc., are held, and in estimating their balance sheet for this year and in order to be in a position to let plots at 1s. 3d. per rod, the executive relied on a good profit from this source. A profit also was looked for from the trading side of the society—seed potatoes, pea sticks, etc. In both cases, the expectations of the executive have been justified.

The society is in its first year on its new freehold ground, and, therefore, much still remains to be done. It would appear, however, from the financial state of the society at present that no trouble will be experienced this year—probably the heaviest year for expenses—in meeting its liabilities, including repayment of mortgage to the Council, and payment of interest at the rate of 5 per cent. to shareholders.

It should be emphasised that, in piloting through a scheme of this kind many difficulties have to be met. Executives of societies should, therefore, not be daunted by these, but go ahead, determined to overcome all obstacles at all costs. Ground should be decided on and application made to the Local Authority for assistance.

Owing to the fall in wages, the raising of the necessary £600 of share capital has not been an easy matter, and may not be so for any society. Patience is necessary; enthusiasm for the allotment movement is absolutely essential; tact should and must be shown in dealing with the many parties concerned in a venture of this kind; but if the subject is properly tackled, and tackled in a determined spirit, there seems no reason why every war allotment society in the kingdom should not acquire its own freehold and thereby help to make a big contribution to promoting the happiness and contentment of our citizens.

With building extending in many directions, all allotment societies should examine their position at once with a view to providing a permanent home for their members. No time should be lost. Every society should put the necessary machinery into operation at once, and by the co-operation of all members, attain the goal for which all allotment holders strive.

The writer will be happy to assist as far as lies in his power any allotment society which may desire further information. The registered office of the Society is "Rosehaven," Shirley Road, Croydon, Surrey.

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MANURIAL TRIALS WITH OSIERS.

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THE present trials are the outcome of the treatment of osiers after spraying with nicotine soap for insect pests. They were intended primarily to select the best manures, or mixture of manures, from an economical and financial point of view, with a view to further trials. The results are published as there are no records at the present time dealing with manuring of osiers. The plots for the experiments were small since it was expected that only a few would be selected for further investigation on a larger scale. In order to make the details more readily avail-

able, the results are, however, calculated for an acre. The osiers in question are for the production of rods for the manufacture of large baskets (vegetable) and hampers. Under these circumstances quality is not so important as quantity, and the larger the quantity, the larger the return, other things being equal.

After the plantation was successfully treated in May, 1920, for an attack of *Galerucella lineola* and *Crepidodera aurata*, a light dressing ($\frac{1}{2}$ cwt. per acre) of sulphate of ammonia was applied, to stimulate growth and tide the plants over the critical period when a second attack might occur. A part of the plantation was not treated and the marked difference between the returns from the treated and untreated areas made it evident that there were great possibilities for manurial treatment.

The soil in the plantation is a heavy loam with underlying clay and the area where the osiers are growing is generally flat, except in one place. As there is a small stream on the south side, it is an easy matter to flood the plantation during dry weather. Beyond the plantation, the ground rises sharply so that all water drains into the hollow and the stream. By this means the soil can always be kept moist even in the driest weather. The flooding is done on the water-meadow principle, and consists of a gentle soak and not a continual flush of water. By altering the direction of the water every row of plants gets the same treatment and the whole of the plantation is kept in an equal state of moisture. Beyond the light dressing of $\frac{1}{2}$ cwt. of sulphate of ammonia the ground had received no manures previously.

In the spring of 1921, an area was selected for the trials. The ground had been weeded and cultivated, and the osiers were all of the same age and variety (Yellow osier). The area was marked into twenty plots, 4 × 4 yards. On the 21st April, 1921, the manures, which had been separately weighed and packed for each plot, were applied, while the dung was weighed out at the neighbouring farm. With the exception of the dung and lime, the manures were applied as a light dressing in comparison with the usual quantities used for agricultural purposes. The rates of application, calculated per acre, were as follows:—Sulphate of Ammonia 1 cwt., Nitrate of Soda $\frac{3}{4}$ cwt., Kainit 2 cwt., Basic Slag 4 cwt., Superphosphate 3 cwt., Lime 15 cwt., Dung 20 tons.

The quantities of manures used were largely tentative since here was no definite information available. Beyond the pre-

liminary success with a very light dressing of sulphate of ammonia it was uncertain how the others would affect the osiers and as nitrate is regarded as having a bad effect on the quality of the rods, the nitrate of soda was kept very low while the sulphate of ammonia, proving successful, was repeated at twice the first application (of ½ cwt. per acre). The plots were kept small, firstly owing to the difficulty of getting a suitably large piece of ground, and secondly as it was expected that probably the six best plots would have little between them.

Early in June the plots were inspected. Growth had commenced and a general examination showed that some of the plots were already ahead of the others. The best plots were 18 and 19; next 17 and 20; then in order 14, 15 and 16; 13 and 7; 8 9 and 10; 12; 11; 1; 2, 3 and 4; 5 and 6.

At the end of September an examination of the plots placed in order approximately as follows:—18 was best, then 19, followed by 17 and 20, after these 14, 15 and 16; 8; while the others showed little difference.

On the 9th of December the plots were cut and weighed separately. The result is given in Table I.

TABLE I.

Produce of Manured Plots.

Plot.	Manures.	Weight of Production. lb.
1	Nitrate of Soda	12½
2	Sulphate of Ammonia	14½
3	Superphosphate	11
4	Basic Slag	13½
5	Dung	11
6	Kainit and Basic Slag	13
7	Nitrate of Soda and Superphosphate	13
8	Sulphate of Ammonia and Superphosphate	15½
9	No Manure	12
10	Lime	14
11	No Manure	11½
12	Kainit and Superphosphate	13½
13	Nitrate of Soda, Kainit and Superphosphate	14
14	Nitrate of Soda, Kainit and Lime	15
15	Nitrate of Soda and Basic Slag	16
16	Sulphate of Ammonia and Kainit	16
17	Nitrate of Soda, Kainit and Basic Slag	19
18	Sulphate of Ammonia, Kainit and Superphosphate ...	23
19	Nitrate of Soda, Kainit and Dung	20
20	Nitrate of Soda and Kainit	18
X	Sulphate of Ammonia	17

The general progress of the osiers during growth shows that the best plots were markedly superior to the others at a very early stage in their growth. Hence anything which stimulates early growth will probably give the best results. The weighings gave various results, Plots 2, 7, and to a slight extent 13 and 14, were far below expectation, while the osiers flanking these plots were poor, particularly near 1 and 2. To test this a representative area of 4 × 4 yards was selected from the bulk of the osier crop which was manured with sulphate of ammonia at the rate of 1 cwt. per acre and cut. The result is given in Plot X. Soil samples were carefully extracted and it was found that clay appeared about 6 or 7 inches below the surface in a line cutting obliquely across Plots 2, 7, part of 13 and 14; for the rest of the area the clay was 9-12 inches below the surface. The clay was not a solid mass but occurred mixed with the soil and increased at lower depths.

The increase on the manured plots was in two directions (1) length and size, and (2) number. The rods were good and clean stemmed (no side branches) and in the case of Plot 18 the height was 6-7 feet. The poorer plots had fewer and smaller rods, the lowest being only about 3-4 feet high. The results are very much what one would expect, the complete manures giving the highest yields. The next point of interest is that generally superphosphate is better than basic slag. Nitrate of soda did not give quite such satisfactory results as sulphate of ammonia, even allowing for the lighter application. The explanation of this is rather difficult, it may be that the excessive moisture favours bacteria which utilise or destroy the nitrate or that it passes right down through the soil before the roots of the young rods can obtain any benefit from it.

Turning next to the economical or financial side of the trials, the cost of the manures was calculated according to the prices at the time of application. The cost of applying single manures is put at 9d. per acre and for the mixing and application of mixed manures at 1s. per acre. The cost of transport is 1½d. per bolt or bundle (of an average weight of 38 lb.) to the nearest market. The sale price per bolt is reckoned at 3s. although at times it may be considerably higher. (*See* Table II.)

The method of marketing rods varies considerably. In the present case they are sold by the bolt—a bundle measuring 1½ feet across the base. This made financial calculations very difficult as the plots were compared by weight, while the bolt is practically a measure weight. In the circumstances a

very exhaustive series of weights was made, and it was found that since there were much fewer of the larger rods to a bolt than the smaller, any variation due to the individual bolt disappeared when the total was taken in bulk. Accordingly 38 lb. as the weight of the average bolt was taken as the standard. The actual marketing of the bolts of big rods and little rods showed that what at first seemed to be the introduction of a very grave error was remarkably accurate in practice and its application to the crop in general justified.

TABLE II.

Financial Results of Manuring, per acre.

	Total value of increase in crop per acre.	Total cost of production and transport of increase per acre.		Profit or loss per acre on increase.
	£ s. d.	£ s. d.		£ s. d.
1 ...	0 12 0 ...	0 12 6	-	0 0 6
2 ...	3 0 0 ...	0 18 0	+	2 2 0
3 ...	2 8 0 ...	0 16 3	+	1 11 9
4 ...	1 16 0 ...	0 16 3	+	0 19 9
5 ...	2 8 0 ...	3 2 9	−	0 14 9
6 ...	1 4 0 ...	1 2 9	+	0 1 3
7 ...	1 4 0 ...	1 6 9	−	0 2 9
8 ...	4 4 0 ...	1 12 9	+	2 11 3
9 ...	— ...	-		-
10 ...	2 8 0 ...	2 0 6	+	0 7 6
11 ...	.. ...	—		-
12 ...	1 16 0 ...	1 2 9	+	0 13 3
13 ...	2 8 0 ...	1 14 6	+	0 13 6
14 ...	3 12 0 ...	2 19 6	+	0 12 6
15 ...	4 16 0 ...	1 10 3	+	3 5 9
16 ...	4 16 0 ...	1 6 6	+	3 9 6
17 ...	8 6 6 ...	1 19 11	+	6 6 7
18 ...	13 2 6 ...	2 6 11	+	10 15 7
19 ...	9 10 6 ...	4 6 9	+	5 3 9
20 ...	7 2 6 ...	1 4 11	+	5 17 7
X ...	6 0 0 ...	1 0 6	+	4 19 6

No. 9 12 lb.—3,624 lb. per acre at 8s. 1b., approx. £14 5s. per acre. Cost of production, &c., not known.

During the year 1922, the trials were much more limited, and two types were selected for quantity tests—sulphate of ammonia for 3-year-old osiers and the manures of Plot 18 for 1-year-old osiers on a higher and consequently a drier area. For the year-old osiers, three areas each of 28.5 sq. yards were selected and the manures applied as under:—

	Superphosphate	*Kainit*	*Sulphate of Ammonia*
No. 1 ...	4 cwt. ...	3 cwt. ...	2 cwt. per acre
„ 2 ...	3 „ ...	2 „ ...	1 „ „ „
„ 3 ...	1½ „ ...	1 „ ...	1 „ „ „

No. 2 was at the same rate as Plot 18 of 1921.

For the 3-year-old osiers, the plots were each of 225 sq. yards. The sulphate of ammonia was applied as follows, per acre:—No. 4, 2 cwt.; No. 5, 1 cwt.; No. 6, ¾ cwt.

The results on the drier areas were very poor and the yields less than the unmanured plots of 1921. The highest was 3,396 lb. per acre, while the unmanured Plot 9 (of 1921) gave 3,624 lb. per acre.

The yields per plot were:—No. 1, 3,396 lb. per acre; No. 2, 3,227 lb. per acre; and No. 3, 3,396 lb. per acre (the same as No. 1).

The obvious conclusion to be drawn from these is that unless there is a plentiful supply of water, manures will produce no increase. Even the superphosphate failed to stimulate the roots and enable them to grow down and obtain water from a lower level. The failure of the plots on the higher ground where the increased and decreased application of complete manures was carried out, prevented any further progress in that direction.

As regards the 3-year-old osiers, there was a steady increase with each additional application of sulphate of ammonia:—No. 4, 15,440 lb. per acre; No. 5, 14,830 lb. per acre; No. 6, 12,710 lb. per acre.

The untreated area gave 11,800 lb. per acre. The increase in No. 4 is, therefore, 3,640 lb., No. 5, 3,030 lb. and No. 6, 910 lb. The large increase from Plot 6 to Plot 5 is probably due to a spell of wet weather in the early stage of the trials when weeds grew vigorously and doubtless obtained a large share of the manure. The higher applications of Plots 5 and 4 would not show this loss to the same extent.

Plot	*Value of Increase*	*Cost of Manuring*	*Profit*
4 ...	£11 7 0 ...	£1 15 3 ...	£12 11 9
5 ...	£11 19 0 ...	£1 2 3 ...	£10 16 9
6 ...	£3 2 0 ...	£0 12 0 ...	£2 10 0

The results of the trials, although by no means conclusive, show that manuring osiers will pay, at least on certain types of soil. Although it may not be so satisfactory in the case of rods used for fine and delicate basket work, there seems no reason why it should not be successful, provided too much nitrogen is not supplied. Experiments alone will decide this point. In spite of the small size of the plots, and the errors that will arise in calculating per acre on such a small scale, and also the none too satisfactory calculation of bolts by weight, there is still such a margin that the most generous calculation

for errors will not affect to any degree the financial resu... The actual returns from the whole area after manuring wi... sulphate of ammonia show a very marked increase, particula... on the financial side, which is after all the test for the grow...

Unfortunately the area which has been under investigat... is not satisfactory for large scale trials, and the difficulty ... controlling experimental areas so far from the College and ... difficulty of absence from departmental duties makes a... further work impossible. The results are, therefore, publish... as they stand in the hope that it may help others with mo... time and better opportunities for carrying out such work.

In conclusion the writer wishes to thank A. Body, Esq., ... Plymouth, without whose generous help and permission the... trials could not have been carried out, and his colleagues a... the staff of Seale-Hayne College, for assistance.

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LIVER ROT OF SHEEP.

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AN account of the outbreak of liver rot in North Wales in 1920-21, with a report on some spraying experiments carried out by the author against the host snail was published in this *Journal* for May, 1922, p. 154. Further observations and a continuation of the experiments are described below.

The violent outbreak of this disease in 1920-21 died down during the hot dry summer of the latter year, the host snail being reduced from extreme abundance to probably less than normal numbers. Numerous drainage and spraying operations by farmers and others further assisted in this process. The unusually cool, damp summer of 1922 resulted in some local increases, however, and on some of the wetter lands infected livers were again reported. In most cases precautionary measures were taken and no severe losses have been reported even during the wet winter of 1922-23; the only cases noted were an odd one here and there, far below the normal of average years before the epidemic.

Accounts of the epidemic and experiments undertaken in connection with it and their results will be found in the following sources:—(1) This *Journal* (see above); (2) Report of the Department of Agriculture of the University College of North Wales,

...uary, 1922; (3) Advisory Leaflet No. 1, Department of ...culture, University College of North Wales, September, ...22. In these publications dusting and spraying experiments ... described, copper sulphate in powders and solutions being ...d with good results against the snails which act as inter...diate host for the parasite causing the disease (*Fasciola ...tica*).

Since these articles were written there has been a good deal ...cussion and observation with regard to the snails acting ... intermediate host with the following important results. ...re are present in North Wales three distinct species of fresh...er snails of the genus *Limnaea*, these being (*a*) *L. truncatula*, ... small species, very abundant, and the usual carrier and inter...diate host of the flat worm causing liver rot; (*b*) *L. peregra* (*...ereger*), a larger and stouter species, equally common, but ...rally found on softer mud than the former; and (*c*) *L. ...stris*, a species as large as (or larger than) *peregra*, but with ...ger, narrower, darker and more pointed shell. Further, ...stris is a much less widely distributed species than the other ...o, although locally abundant, as on parts of the Malldraeth ...sh (Anglesey), the Abergele district and elsewhere. During ...k on these snails in Mid and North Wales the writer had ...eral times obtained from *L. peregra* young (larval) flukes indis...guishable from those causing liver rot, and so common in *L. ...catula*. Dr. Monica Taylor (in recent letters to "Nature") ...lieves that this snail (*peregra*) is the usual carrier in some ...ts of Scotland, where liver rot occurs and *L. truncatula* is ... or absent. Such being the case it becomes necessary for ...h farmers and others to regard this second and very common ...s as probably dangerous, and to destroy it whenever ...ble. Fortunately the means advocated for the one are ...ly effective for the other. No incriminating evidence seems ... yet to have been obtained against *L. palustris*.

Experiments with Sulphate of Ammonia and Copper Sulphate.—In the autumn of 1922 Professor R. T. Leiper drew ... writer's attention to the suggestive results obtained in some ...boratory experiments carried out in the Department of Helminthology in the London School of Tropical Medicine, in ...hich ammonium sulphate was found to kill *L. truncatula* and ... eggs. Further, Dr. Khalil found that solutions of 1/1000 of ... crude fertiliser killed the egg masses of *L. peregra* and *...morbis corneus* in 6 hours.[2] It was therefore resolved to

[2] *Journ. Tropical Medicine and Hygiene*, March, 1922.

carry out a series of field experiments against *Limnaea* in North Wales, using sulphate of ammonia. A very suitable situation was found at Tyddyn Mawr, Holland Arms, Anglesey, and thanks are due to the owner and occupier, Mr. H. O. Williams, and his son, for their kind assistance during these experiments. Sulphate of ammonia, if successful, would have had several marked advantages (*a*) as an egg killer, (*b*) as being non-poisonous, (*c*) as having a manurial value. So far, however, it has not proved an efficient snail killer in field practice. The experiments may be summarised as follows :—

(*A*) The application of 30 lb. of commercial sulphate of ammonia, by hand, to 500 square yards of grass land, flooded from a damaged drain, and heavily populated with *L. truncatula*, 12th December, 1922. This dressing equalled 2.6 cwt. per acre at a cost of about £2 per acre. The amount of water present was estimated at an inch deep, giving a solution of 1/780 or 0.13 per cent. This, however, did not kill the snails, which remained unaffected. There was a slight flow of water on this area at the time of application. Laboratory experiments had indicated 1/1000 as effective against eggs.

(*B*) A ditch, about a foot deep, with a gentle flow down the centre between clayey banks, containing numerous large *L. peregra*, many *L. palustris*, and a few *L. truncatula*. This was treated (12th December, 1922) with a dust composed of 1 part of dry neutral sulphate of ammonia and 2 parts of kaolin (china clay). This latter was used as a spreader and "tracer." Application was by a hand bellows. A hundred square yards were treated at an approximate cost of £1 9s. per acre. Twenty-four hours later the death rate was found to be 70 per cent.—that in a ditch chiefly inhabited by *L. peregra*.

(*C*) A similar ditch, but wider and more stagnant, with no obvious flow. *L. peregra* was present but not abundant. Fifty square yards were dusted with equal parts of neutral sulphate of ammonia and china clay (12th December, 1922). All the snails subsequently found and examined were dead, but the numbers were not great.

(*D*) 100 square yards of damp or slightly flooded grass land (same situation as *A*) were dusted on 8th March, 1923, with equal parts of dry neutral sulphate of ammonia and china clay at the rate of 1 cwt. of each per acre. *L. truncatula* was very abundant. The results are discussed below, with (*E*).

(*E*) 60 square yards (alongside *D*) were dusted with equal parts of fine powdered copper sulphate and china clay, also at the

rate of 1 cwt. of each per acre. *L. truncatula* was very abundant. 300 snails were collected 24 hours later and placed in clean water in the laboratory, and showed the following results:—

(*a*) 50 snails dusted with sulphate of ammonia, on damp mud: 10 per cent. dead.

(*b*) 50 snails dusted with sulphate of ammonia, in shallow water: 5 per cent. dead.

(*c*) 100 snails dusted with sulphate of ammonia, from mud and shallow pools: 10 per cent. dead.

(*d*) 50 snails dusted with copper sulphate, on damp mud: 100 per cent. dead.

(*e*) 50 snails dusted with copper sulphate, in shallow water: 100 per cent. dead.

The foregoing experiments would seem to show that sulphate of ammonia is of little value under field conditions in North Wales against *L. truncatula*, but has greater killing power for *L. peregra*. On the other hand, copper sulphate was as successful as in the earlier experiments, and is therefore still to be recommended, with the usual precautions as to avoidance of stocking treated ground until after heavy rain, and the exercise of care in treating flowing streams that may be used for watering stock, or may affect fishing waters, etc. An interesting case occurred in which a large and valuable flock of sheep was discovered to be grazing fields parts of which were swarming with *L. truncatula*, and nevertheless remained healthy. No larval flukes could be obtained from several large batches of these snails which were apparently not affected and were therefore, for the time being, harmless. This flock had suffered severely during the epidemic.

Several ditches, etc., cleared of snails by the use of bluestone dusts 18 to 24 months previously were re-examined and found to remain free of snails, but one flowing stream, in Anglesey, had been repopulated throughout its length with *L. peregra*, by migration from side streamlets.

In one instance several large damp grass fields swarming with *L. truncatula* (and the cause of very heavy losses in 1920-21) were ploughed and put under oats. This treatment was successful; only two specimens were detected in a damp place between furrows during subsequent examinations. These fields were again seeded down with the oats, and the resultant grass fields were practically clear of snails when examined, thus indicating a method of treatment of value on such land.

The value of ducks was also further demonstrated by the examination of a shallow stream running through the grazing

lands of a series of farms, many of which were affected during the epidemic. Where the stream passed near the homesteads and ducks were kept, no snails could be discovered, but away from the buildings, where the ducks did not range, *L. truncatula* and *L. peregra* occurred, in some cases in thousands.

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"SLEEPY DISEASE" OF THE TOMATO.

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THE term "Sleepy Disease" as used by the average nurseryman in this country covers a number of separate diseases, the most important of which is *Verticillium* wilt. Of the other diseases included under this general title may be mentioned *Fusarium* wilt, and root rot caused by *Vermicularia varians*, Ducomet. Plants attacked by different species of *Fusarium* following wireworm injury also come under the same category.

Verticillium wilt usually appears about the middle of April and increases in severity up to the second and third week in May. Fresh cases are rarely found during the second half of June, July and August, but the disease frequently reappears in September and the attacked plants die prematurely. *Fusarium* wilt requires a high temperature and occurs only at the hottest time of the year. Death by *Vermicularia varians* usually takes place in August or September, while cases of root rot may be found continuously through the season. As *Verticillium* wilt is the most important disease of this class, it forms the subject of the remainder of the article.*

Plants attacked by *Verticillium albo-atrum* are usually stunted in appearance, and the youngest internodes are badly developed. Under conditions of light and temperature favourable to the fungus the disease symptoms appear quite suddenly and the plant wilts while still green. During the night the plants may recover their turgidity, but wilt again as the morning advances. The leaves wither from the base of the plant upwards, adventitious roots emerge from the stem and the plant dies. Under conditions less favourable to the fungus, the process of death is much slower: yellow blotches appear on individual leaflets on the lower leaves and these leaflets wither. This process continues slowly up to the top of the plant, when death occurs. When the plant is dead the fungus within it grows out to the air.

* A full account of this disease has been published in the "Annals of Applied Biology," Part 2, Vol. 9, 1922, to which further reference should be made.

and produces a white spore-bearing layer of hyphæ which covers the surface of the stem near to the ground. A great many spores are produced and serve to disseminate the disease.

On cutting open a diseased plant in a longitudinal direction, it will be seen that the wood is distinctly brown in colour as compared with that of a healthy plant. This browning of the wood is a common phenomenon connected with the presence of a fungus, and may be seen also in plants suffering from *Fusarium* wilt, *Vermicularia* root rot, etc. *Verticillium* wilt, however, may be readily distinguished from these other diseases, for in this disease, the browning of the wood generally extends to within a few inches of the top of the plant, while in the other diseases mentioned it is rarely found higher than a foot above ground.

The causal organism, *Verticillium albo-atrum*, may be isolated readily by transferring a small piece of infected wood to a tube of sterile medium. Inoculations performed by pricking a small piece of hyphæ from a pure culture into the stem of a healthy plant invariably cause wilt in from two to six weeks according to the temperature conditions to which the plant is exposed. While wounds are an assistance to infection, it has been proved by carefully controlled experiments that they are not essential.

The fungus possesses a wide host range and during our investigation has been isolated from wilted potatoes, snapdragons, cucumbers, pepper plants, sweet peas and cotton plants. The strain isolated from a tomato plant readily attacks the above plants, also the egg plant, sycamore, and elm.

The Relation between Temperature and the Incidence of the Disease.—Monthly inoculation experiments yielded results which seemed to indicate that a close relation existed between environmental conditions, especially temperature, and successful infection. Further investigation was deemed necessary.

As a series of glasshouses, where different temperatures could be constantly maintained, was not available, inoculated plants (hypocotyl stab) were placed in different positions in the experimental houses, corridors, etc., under different average temperature conditions. Twelve plants were placed in each position, and the average temperatures were calculated from readings taken twice daily from maximum and minimum thermometers placed beside the plants. The final observations, shown in the following tables, were taken twenty-one days after inoculation, and where figures are given they represent the average obtained from twelve plants.

TABLE I.

Progress of Disease in different Temperatures.

	Frame	Corridor	Tomato House	Cucumber House
Average temp. F.	54·6°	62·4°	70·3°	77·2°
Absolute min. F.	42°	52°	54°	68°
Absolute max. F.	69°	73°	82°	92°
Date of inoculation	14/1/20	14/1/20	14/1/20	14/1/20
No. of days from inoculation ...	21	21	21	21
Ratio of wilted to total leaves ...	0/10	6/12	8/12	0/12
Height of discoloured wood above stab	15 cms.	26 cms.	28 cms.	9 cms.
No. of days from inoculation until complete wilt	49	28	28	No wilt after 80 days

While the results obtained are open to criticism because of the wide range of temperature to which the plants were submitted in any one position, certain facts emerge which have been fully confirmed by observations on commercial nurseries. Chief among these are the beneficial effects which shade and temperatures above 75° F. have upon plants suffering from wilt. Table I shows that average temperatures of 63° F. and 70° F. are favourable to the rapid progress of the disease, that of 54° F. is unfavourable, while that of 77° F. practically inhibits it. It will be seen that the organism has travelled most rapidly up the stem, as indicated by the browning of the wood, at 63° F. and 70° F., and at these temperatures also complete wilt occurred most rapidly. The results shown in Table II. while confirming the temperature relations shown in the preceding table, also show the beneficial effect of shade. While

TABLE II.

	Frame	Tomato House		Cucumber House	
		Unshaded	Shaded	Unshaded	Shaded
Date of inoculation	14/1/20	14/1/20	14/1/20	14/1/20	14/1/20
No. of days from inoculation ...	21	21	21	21	21
Average temperature	62·1°F.	71·5° F.	68·9° F.	79·3 F.	77·1 F.
Ratio of wilted leaves to total leaves	6/10	3/10	0/10	0/10	0/10

plants in the unshaded house readily wilted, those in the shaded house, although the temperature was favourable to the disease, did not wilt.

General observations have also shown that temperatures between 60° F. and 75° F. with an optimum of 70-73° F. are favourable to the rapid progress of *Verticillium* wilt, which below 60° F. and above 75° F. is exceedingly slow, while suitable shading counteracts the effect of low temperatures.

A series of experiments were next arranged in which wilted plants were transferred to high temperatures to ascertain if they

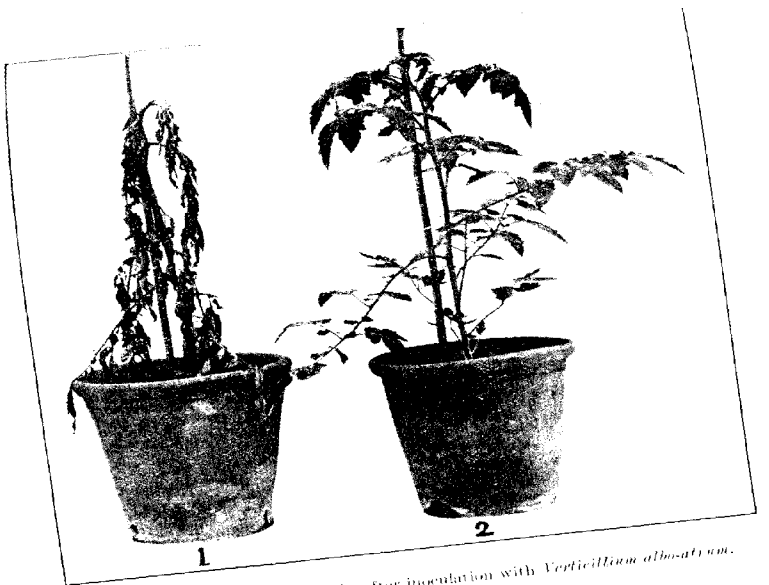

FIG. 1. (1) Wilted plant 6 weeks after inoculation with *Verticillium albo-atrum*.
(2) Control plant.

(Figs. 1 and 2 reproduced by kind permission of The Association of Economic Biologists.)

FIG. 2. Showing the wilted plant after being submitted to shade and an average temperature of 25° C. (77° F.). The wilted leaves have fallen but the plant has recovered

would recover, and if such a recovery would continue when they were returned to lower temperatures. The results given in Table III indicate that wilted plants recover when the average temperature is raised to 77° F. and they are shaded. When such a temperature is operative for a short time the effect is not a lasting one, for the plants rapidly wilt again when the temperature is lowered. Longer exposures to the high temperature produce a more lasting result, for after 75 days at 77° F. the plants remained turgid for 30 days at a temperature favourable to wilt. Table IV compares the percentage of wilted plants which recover when transferred to a shaded house at an average temperature of 77° F., with that of similar plants transferred to an unshaded house at the same average temperature.

TABLE III.

Effect of High Temperature and Shade on Wilted Plants.

No. of wilted plants	Length of time in shaded cucumber house. Average temp. 77° F.	Effect of high temperature	Length of time after returning to average temp. 70° F. before plants wilted again
12 ...	1 day ...	Recovered ...	15 hours
12 ...	2 days ...	,, ...	15 ,,
12 ...	7 ,, ...	,, ...	2 days
12 ...	14 ,, ...	,, ...	3 ,,
12 ...	30 ,, ...	,, ...	16 ,,
12 ...	75 ,, ...	,, ...	30 ,,

TABLE IV.

Effect of High Temperature with and without Shade on Wilted Plants.

No. of wilted plants	No. of days wilt has been visible prior to experiment	Per cent. recovered in shaded cucumber house. Average temp. 77° F.	Per cent. recovered in unshaded cucumber house. Average temp. 77° F.
20 ...	2 ...	100 ...	100
20 ...	7 ...	100 ...	100
20 ...	14 ...	100 ...	100
20 ...	21 ...	100 ...	90
20 ...	30 ...	100 ...	80

Plants in different stages of wilt were used, from a series where the wilt was just commencing to show to a series in an advanced stage after 30 days' wilting. All the plants recovered in the shaded house, but only a percentage recovered in that which was not shaded. The plants which did not recover in the unshaded house, being badly wilted ones, were probably desiccated before they had a chance to recover.

These observations appear to justify the conclusion that temperature is a most important factor, while shading is valuable because it assists the plant by reducing transpiration. The

minimum, optimum and maximum temperatures for growth in pure culture of the strains of *Verticillium albo-atrum* utilised for the inoculation were 40° F., 74° F. and 86° F., respectively. It will be seen, therefore, that the optimum temperature for infection coincides approximately with the optimum temperature for growth in pure culture. *Verticillium* wilt is distinctly a disease of low temperatures and is most severe in spring and autumn.

Shade.—Shade, as we have seen, has a beneficial effect upon the resistance of the host to the disease. Probably this is due to retarded transpiration and consequently to the decreased rate of conduction of the water in the vessels, so that the toxic products excreted by the fungus are not carried up the plant in such large amounts.

Soil Factors.—Experiments carried out with soils of different types show that *Verticillium* wilt is not restricted to any particular type. Generally speaking, plants on soils which contain a large amount of humus yield a greater amount of disease than those growing on soils of a poorer nature. Clay soils, in virtue of their greater water-holding capacity, are cooler than sandy soils, and plants grown upon them are more prone to wilt than those grown on the latter.

Control.—Further work is in progress to determine a suitable chemical agent which will sterilise the soil and effectively cleanse it of the wilt-producing organisms. Investigations are also being carried out on the efficacy of manurial treatment in rendering the plants resistant to fungal attack, but it is too early to suggest any treatment.

Cultural Methods.—Cultural methods for the control of the wilt have been devised, and have been tested with promising results.

It is commonly held by pathologists that plants exhibiting hard growth are more resistant to disease than the more succulent types, but observations on wilt disease show in this case the reverse to be true, the harder growing varieties succumbing more readily than the more succulent ones. The only variety, Manx Marvel, which so far has proved highly resistant to *Verticillium* shows a distinctly free growth with thick stems and large leaves.

It has been specially noted that plants, starved in the early stages, or having suffered from a severe check are highly susceptible. Also it has been mentioned previously that the average temperature of the air and soil are limiting factors in

the incidence of the disease. The disease is first seen in spring, when the temperature is low, but with the coming of the higher summer temperature the wilted plants recover, and the percentage mortality of the plants infected in the spring depends upon the length of time the cold weather lasts.

The incubation period for the disease varies from eight to twenty days under favourable conditions and complete wilt and death occur in from six to eight weeks after the first symptoms appear, if conditions are favourable for the fungus. Should the temperature be sufficiently raised before the plant dies, it will recover and produce a satisfactory crop during such time as the temperature remains high. Once the temperature drops in the autumn, wilt reappears, and the plant dies prematurely. Early summer temperatures, therefore, enable the plant to resist the fungus. It will at once be evident that good results may be obtained by artificially shortening the period of low temperature, and in glasshouses this may be done by increasing the boiler heat, and closing down the houses in the middle of the day.

The following cultural methods for controlling the disease have given satisfactory results. As soon as the wilt appears and it is proved that *Verticillium albo-atrum* is the cause, the average temperature of the houses should be raised above 77° F. by suitably increasing the boiler heat, regulating the ventilation, and closing down the houses for from two to four hours in the middle of the day. A thin coat of whitewash on the glass makes the conditions still more favourable for the plants. As little water as possible should be given to the roots, as heavy watering merely aggravates the wilting, but a light overhead damping helps the wilted plants to recover. The plants should be encouraged to make fresh roots by heaping up the soil round the base of the stem.

In one case sixty-eight per cent. of the plants in a nursery were showing symptoms of wilt disease before the above methods were enforced, but a fortnight after only ten per cent. remained wilted. In view of the fact that the low spring temperatures are favourable to infection by *Verticillium*, some advantage might be gained by planting later than normally, so that the higher summer temperatures may arrive by the time the plants have reached a suitable stage for infection.

Examination of the effect of kind of soil upon the incidence of the disease has shown that soils rich in humus yield a higher percentage of diseased plants than those of a poorer nature.

Results obtained on the experimental plots at this station confirm this—the greatest percentage of *Verticillium* wilt occurs on the plots receiving complete artificials with large amounts of dung.

The Elimination of Sources of Infection.—Too much stress cannot be laid on the fact that it is useless to sterilise the soil if centres of infection are allowed to exist in the neighbourhood of the nursery.

Certain workers have pointed out that *F. lycopersici* will develop much more rapidly in sterilised soil than in ordinary unsterilised soil. Presumably this is due to the fact that sterilisation eliminates a large number of bacteria and fungi organisms. We have found the same to be true for *Verticillium albo-atrum*, for plants growing in incompletely sterilised soil or re-inoculated sterilised soil have a higher percentage of disease than those in unsterilised soil. This is accentuated if the soil be exceedingly rich in humus, as is the case with sterilised cucumber soil, which is frequently used for tomato growing. The determination and elimination of infection centres thus become of vital importance. The fungal outgrowths at the base of dead diseased plants produce innumerable spores which become widely disseminated. These in themselves will not carry the fungus over the period of winter, being destroyed by drying, but they readily germinate, and feeding on decaying plant material, produce carbonised hyphæ and microsclerotia, which are able to withstand winter conditions. Close examination has been made of small pieces of plant remains which have been unearthed from nursery soils, after the crop has been removed, and numerous tomato pests, including *Verticillium albo-atrum*, have been found upon them. Thus it is important to remove completely all dead plants before the fungal outgrowths appear, and in the process of cleaning up the nursery when the crop is finished, to remove carefully as much as possible of the dead plant-remains. Careful attention to these matters will prevent the rapid spread of the disease. The best way to remove the crop, when completed, is to sever each plant about three inches from the ground before attempting to remove the roots. If the surface is quite clean before the roots are removed there is less chance of incorporating diseased material in the soil and the roots may then be carefully taken up, leaving behind only the very fine rootlets.

Another source of infection which becomes more and more evident is the contamination carried in "strikes" or baskets,

and a considerable number of cases have been noted, where infection with various diseases came from these articles. Such baskets may be so mixed at the market, that when they are returned, those from one nursery are sent to another and so disease is spread. Baskets should not be taken near to the growing plants for fear of introducing some new trouble, and during the winter months all baskets should be sterilised in readiness for the coming season. The importation of young plants from other nurseries is a procedure to be deprecated, for it is a fruitful means of disease transmission. Contaminated water from surface wells is a constant source of infection with many diseases, and care should be taken to use a pure water supply. Potatoes and antirrhinums should not be grown in the vicinity of tomatoes as they are susceptible to *Verticillium*.

Disease Resistant Varieties.—The production of resistant varieties has offered the most satisfactory and in some cases the only effective means of controlling a number of plant diseases. An attempt is now being made to raise a *Verticillium*-resistant tomato, the necessity being borne in mind of producing a plant which will yield a good crop of well-formed fruit.

* * * * * *

THE PRINCIPLES OF POULTRY FEEDING.

II.

Value in Comparison with other Feeding Stuffs.—The value of any feeding stuff can be estimated with accuracy only after taking into consideration many factors, and poultry-keepers desiring to familiarise themselves with these factors should study "*Rations for Live Stock*," by Professor T. B. Wood, of Cambridge University.*

Briefly, it may be said here that whilst experimental work in connection with cattle, horses, sheep and pigs has advanced so far that the quantities of digestible proteid and starch equivalent required daily by idle horses, horses on heavy work, store cattle, cows giving different quantities of milk, etc., are known, no similar information regarding poultry is available.

In the meantime, probably the best method for the poultry-keeper who wishes to estimate the value of any feeding stuff

* Miscellaneous Publication No. 32, to be obtained from the Ministry, 10, Whitehall Place, S.W.1. Price 6d. net, post free.

for his poultry will be to examine the digestible nutrients shown in the table, to take into consideration the amount of fibre and ash or mineral matter which the feeding stuff contains, and then to calculate the proportion between the proteids on the one hand and the carbo-hydrates and fats on the other hand which the total ration contains. This proportion is known as the nutritive ratio and is shown in the table for each individual feeding stuff. For example, in the case of maize and maize meal, it will be seen that for every part of proteids there are 11 parts of carbo-hydrates and fat. This ratio is calculated by multiplying the percentage of oil by 2.5, adding the percentage of digestible carbo-hydrates and dividing the result by the percentage of digestible proteid. For example, in the case of maize :—

$$\frac{(\text{Digestible oil} \times 2{\cdot}5) + \text{Soluble Carbo-hydrates.}}{\text{Digestible Proteid.}}$$

$$\frac{(3{\cdot}9 \times 2{\cdot}5) + 65{\cdot}7}{7{\cdot}1} = \frac{75{\cdot}45}{7{\cdot}1} = 10{\cdot}82 = \text{approx. } 11,$$

therefore nutritive ratio is as 1 is to **11.**

This ration is found in practice to be too wide to form the whole ration for laying hens; the proteid content is too low and the fat-producing constituents are too high. The maize therefore is given in conjunction with other feeding stuffs richer in proteid and of a less fattening nature. It is necessary therefore to calculate the nutritive ratio of the total mixture, and the simplest way of making this calculation is to ascertain the total digestible proteid and the total digestible carbo-hydrates and fat in the mixture and then work out the ratio as in the case of a single feeding stuff. Take for example the following ration :—

2 lb. of bran, 4 lb. middlings, 1 lb. of Sussex ground oats, 1 lb. of maize gluten feed, 1 lb. of clover meal, 1 lb. of fish meal.

Assuming that the grain feed used with this ration is

2 lb. maize, 1 lb. wheat, 1 lb. oats,

and that the poultry receive during the day equal weights of the grain and mash rations; it is of little value calculating the nutritive ratio of the mash alone, and therefore the total food given through the day must be considered. Now on referring to the table, it is seen that bran contains 10.6 per cent. digestible proteid and therefore 2 lb. of bran will contain 0.212 lb. of this constituent. The table also shows that bran contains 5 parts carbo-hydrates and fats to every part of proteid and therefore 2 lb. of bran will contain 1.06 lb. digestible

arbo-hydrates and fats. Following this method, the following alculation can be made:—

	Digestible Proteid.				*Digestible Carbo-Hydrates and Fats.*
2 lb. bran	0·212	×	5	=	1·060
4 „ middlings (coarse)	0·552	×	4	=	2·208
1 „ Sussex ground oats	0·080	×	7	=	0·560
1 „ alfafa (lucerne)	0·032	×	2	=	0·064
1 „ maize gluten feed	0·200	×	3	=	0·600
1 „ fish meal	0·727	×	0	=	0·000
2 „ maize (kibbled)	0·142	×	11	=	1·562
1 „ wheat	0·102	×	7	=	0·714
1 „ oats	0·080	×	7	=	0·560
Total... ...	2·127				7·328

herefore nutritive ratio of total day's ration

$$= 1 : \frac{7{\cdot}328}{2{\cdot}127} = 1 : 3{\cdot}4.$$

This ration for mash and grain is one which is often used, but it has a narrow or high nutritive ratio and it is doubtful whether such a high quantity of proteid in the daily feed is either necessary or advisable.

The following ration gives a wider nutritive ratio and is of a less forcing nature, but would probably produce equally as many eggs as the first ration with less risk to the health of the birds. A ration with a narrower nutritive ratio than 1 : 4 is probably unnecessary for laying poultry and there is some evidence to show that an even wider ratio than 1 : 4¼, which is shown by the ration below, would give equally good results, whilst being cheaper and safer to use.

	Digestible Proteid.				*Digestible Carbo-Hydrates and Fats.*
2 lb. bran	0·212	×	5	=	1·060
2 „ middlings	0·276	×	4	=	1·104
2 „ Sussex ground oats	0·160	×	7	=	1·120
3 „ maize meal	0·213	×	11	=	2·343
1 „ alfalfa (lucerne)	0·032	×	2	=	0·064
1 „ fish meal	0·727	×	0	=	0·000
1 „ wheat	0·204	×	7	=	1·428
1 „ oats	0·080	×	7	=	0·560
1 „ maize (kibbled)	0·071	×	11	=	0·781
	1·975				8·460

erefore nutritive ratio of total day's ration

$$= 1 : \frac{8{\cdot}460}{1{\cdot}975} = 1 : 4{\cdot}28.$$

Neither the composition of the egg nor of the body of the hen is a correct guide in deciding upon a suitable nutritive ratio. The following figures show the composition of the egg and also of the hen's body:—

Egg:—Protein 11·1, Fat 10·12, Ash 1·0

$$\text{therefore nutritive ratio} = 1 : \frac{10{\cdot}12 \times 2{\cdot}5}{11{\cdot}1} = 1 : 2{\cdot}28$$

Fowl:—Protein 12·49, Fat 2·98, Ash 0·57

$$\text{therefore nutritive ratio} = 1 : \frac{2{\cdot}98 \times 2{\cdot}5}{12{\cdot}49} = 1 : 0{\cdot}59.$$

Based on this analysis, the nutritive ratio of the egg itself is very high, namely, 1 to 2.28 whilst that of the body of the fowl is even higher, 1 to 0.59. To feed laying hens on a ration possessing so narrow a nutritive ratio as either of these would not only be likely to endanger the health of the birds, but would be a wasteful and expensive method of feeding.

It should be clearly understood that the nutritive ratio is not a complete guide to the feeding value of a ration. Such questions as bulk, the inclusion of mineral salts, palatability and general suitability as a poultry food must also be taken into consideration, but generally speaking, the nutritive ratio is a useful guide to the poultry-keeper in making up his rations.

Much doubt exists in the minds of many poultry-keepers as to which is the cheapest food stuff to buy at the various market prices quoted, and in "*Rations for Livestock*," column 17 of the tables shows the "linseed cake equivalent" of many of the feeding stuffs. The figures in this column give the number of lb. of average linseed cake required to produce in quadrupeds as much growth, fat, milk or work as 100 lb. of the feeding stuff to which the figures apply, and so they permit a reliable comparison of the productive value of different feeding stuffs. As linseed cake is not used, except perhaps to a negligible extent, in feeding poultry, maize meal has been taken for comparison for the tables of this leaflet. The last column of the tables shows approximately the number of lb. of maize meal which have the same productive value as 100 lb. of the feeding stuff indicated. It should not be inferred from these figures that maize meal should be given undue prominence in a ration, or that it should be used to an undue extent by itself; but other considerations being equal, the figures show the relative value of maize meal compared to other feeding stuffs in a poultry ration. The maize meal equivalent is also useful for arriving at a rough estimate as to the cheapest feeding stuffs in the market. Strictly speaking, the manurial value should be taken into con-

sideration before this comparison is made, but since poultry manure at present is not regarded by the poultry-keeper as of the same importance as the farmer regards farmyard manure, this consideration may be ignored at the moment.

Feeding Stuffs.	Chemical Analyses.						Digestible Nutrients.				
	Dry Matter.	Proteid.	Fat.	Soluble Carbo-hydrates.	Fibre.	Ash.	Proteid.	Oil.	Soluble Carbo-hydrates.	Nutritive Ratio.	Maize Meal Equivalent (per 100 lb. Maize).
... ...	11·0	1·5	0·4	5·9	2·0	1·2	1·1	0·2	4·6	1: 6	6·5
...nd Maize Meal ...	87·0	9·9	4·4	69·2	2·2	1·3	7·1	3·9	65·7	1:11	100·0
... ...	87·5	10·6	3·9	61·1	8·1	3·8	8·0	3·1	45·8	1: 7	70·0
... ...	86·7	10·3	4·8	58·2	10·3	3·1	8·0	4·0	44·8	1: 7	71·0
... ...	86·6	11·5	1·7	69·5	1·9	2·0	9·6	1·1	63·9	1: 7	88·0
...n Grass	20·0	3·5	0·8	9·7	4·0	2·0	2·5	0·1	7·3	1: 4	10·7
...n Grass	24·8	2·9	0·7	11·5	7·1	2·6	1·8	0·3	7·4	1: 7	8·2
... ...	19·0	3·4	0·7	8·1	5·2	1·6	2·5	0·5	6·3	1: 4	9·0
...e Meal	89·2	72·2	13·2	—	—	3·8	67·2	12·5	—	—	114·0
... Middlings	87·3	15·7	3·4	64·0	1·8	2·4	13·2	3·0	52·0	1: 5	89·0
... Middlings or Sharps	86·5	16·4	5·0	56·2	3·3	8·6	13·8	4·3	45·5	1: 4	75·0
... ...	86·7	14·3	4·8	55·6	7·7	4·3	11·6	4·0	44·5	1: 5	69·0
...dried)	95·7	18·5	0·5	35·5	0·5	10·7	41·6	0·2	29·2	1: 1	86·0
... Meal	86·0	81·0	0·8	1·5	—	2·7	72·7	0·8	—	—	78·0
... ...	86·6	12·1	1·9	69·0	1·9	1·7	10·2	1·2	63·5	1: 7	88·0
...wet Seed	92·5	14·2	32·3	14·5	28·1	3·4	12·8	30·7	10·3	1: 8	118·0
...ers' Grains (wet) ...	26·2	8·4	3·0	10·4	3·6	0·8	6·2	2·6	6·4	1: 2	18·0
...ers' Grains (dry) ...	92·0	27·7	11·6	40·8	10·1	1·8	19·6	10·2	25·3	1: 3	65·0
...ybean	85·9	11·3	2·6	54·8	14·4	2·8	8·5	1·9	42·3	1: 6	62·0
...ley and Barley Meal ...	85·1	8·6	1·5	67·9	4·5	2·6	6·5	1·2	62·2	1:10	85·0
... ...	88·9	9·6	3·8	71·2	1·9	2·4	7·7	3·0	60·5	1: 9	91·0
... ...	87·4	6·7	0·4	78·0	1·5	0·8	5·8	0·2	75·8	1:13	100·0
...ats and Bean Meal ...	85·7	25·4	1·5	48·5	7·1	3·2	20·1	1·2	44·1	1: 2	77·0
...ed and Pea Meal	86·0	22·5	1·6	53·7	5·4	2·8	19·5	1·0	49·9	1: 3	83·0
...ing Seed	91·1	18·2	32·6	21·1	15·0	4·2	13·7	29·3	16·8	1: 7	117·0
... Beans	90·0	33·2	17·5	30·5	4·1	4·7	29·5	15·8	20·8	1: 2	96·0
...n Bean Meal	88·7	44·7	1·5	31·9	5·1	5·5	40·3	1·4	24·7	1: 1	87·0
...(sweet)	12·8	3·4	3·9	4·8	—	0·7	3·2	3·9	4·8	1: 4	21·3
...(clam)	10·0	3·5	0·4	5·0	—	0·8	3·3	0·1	5·0	1: 2	11·4
...ed	92·8	21·2	36·5	22·9	5·5	3·8	19·4	34·7	18·3	1: 5	134·0
...ed Meal	88·2	35·7	3·1	33·9	9·6	6·5	30·8	2·8	27·2	1: 1	74·0
...ermilk	9·2	3·6	0·8	4·1	—	0·7	3·4	0·8	4·1	1: 2	11·4
...ze Germ Meal	89·3	13·0	13·5	55·1	1·1	3·6	10·4	12·8	45·8	1: 7	103·0
...ey Brewers Grain (dry)	89·7	18·3	6·4	45·9	15·2	3·9	13·0	5·6	27·6	1: 4	51·0
...ey Brewers Grain (wet)	32·4	7·5	2·8	14·6	6·1	1·4	5·5	2·4	9·1	1: 3	20·0
...ley Malt Culms	90·0	24·4	2·0	42·4	14·0	7·2	19·9	1·5	30·9	1: 3	38·3
...n Meal	87·0	55·6	1·4	2·1	—	2·7	72·7	0·8	—	—	65·0
...ze Gluten Feed	89·6	23·5	3·4	56·7	3·5	2·5	20·0	2·7	19·3	1: 3	91·0
...ze Gluten Meal	90·9	35·5	1·7	47·5	2·1	1·1	30·6	1·4	42·6	1: 2	101·0

Price comparison is arrived at in the following manner:—If the price of maize meal is £10 5s. 0d. per ton and the price of feed oatmeal £11 15s. 0d. per ton, on referring to the table we find that the maize equivalent of oats is 71, *i.e.*, 71 lb. of maize meal is of the same productive value as 100 lb. of oats; the price of feed oatmeal, namely, £11 15s. 0d. is therefore

divided by 71, showing that the cost per unit of maize meal equivalent in oats is about 3s. 4d. The cost per unit of maize meal would be £10 5s. 0d. divided by 100, namely, approximately 2s., so that unless the poultry-keeper for some particular reason desires to use feed oatmeal instead of maize meal, maize meal is much the cheaper purchase at these prices.

Feeding Stuffs.	Chemical Analyses.						Digestible Nutrients.			
	Dry Matter.	Proteid.	Fat.	Soluble Carbo-hydrates.	Fibre.	Ash.	Proteid.	Oil.	Soluble Carbohydrates.	Nutritive Ratio.
Sussex Ground Oats ...	86·7	10·3	4·8	58·2	10·3	3·1	8·0	4·0	44·8	1 : 7
Oatmeal	91·4	14·0	9·4	65·0	1·2	1·8	—	—	—	
Groats	91·6	14·3	8·7	65·0	1·8	1·4	—	—	—	
Wheat Bran	86·4	13·5	3·9	53·0	10·6	5·4	10·6	2·8	38·0	1 : 5
Clover Meal	83·5	13·5	2·9	37·1	24·1	6·0	8·5	1·7	26·0	1 : 3
Turnips	8·5	1·0	0·2	5·7	0·9	0·7	0·6	—	5·2	1 : 9
Swedes	11·5	1·3	0·2	8·1	1·2	0·7	1·1	—	7·5	1 : 7
Mangolds	13·2	1·2	0·1	10·2	0·8	0·9	0·7	—	9·4	1 : 13
Potatoes	23·8	2·1	0·1	19·7	0·9	1·0	1·1	—	17·7	1 : 17
Parsnips	15·0	1·3	0·3	11·3	1·2	0·9	1·0	0·1	10·9	1 : 12
Carrots	13·0	1·2	0·2	9·3	1·4	0·9	0·8	0·1	8·9	1 : 12
Kohl Rabi	12·7	2·0	0·1	8·2	1·4	1·0	0·7	—	7·4	1 : 11
Mangolds (Yellow-fleshed Globe or Tankard) ...	13·2	1·2	0·1	10·2	0·8	0·9	0·7	—	9·1	1 : 13
Mangolds (Long Red) ...	13·1	1·0	0·1	10·3	0·8	0·9	0·7	—	9·5	1 : 13
Kohl Rabi (leaves)	13·5	2·8	0·4	7·1	1·6	1·6	1·9	0·2	5·7	1 : 3
Kale (Thousand Head) ...	14·8	2·5	0·3	8·7	1·7	1·6	1·8	0·2	7·0	1 : 4
Rape	14·1	2·8	0·8	5·7	3·5	1·3	2·0	0·5	3·9	1 : 2
Lucerne (beginning to flower)	24·0	4·5	0·8	9·6	6·8	2·3	3·2	0·4	6·3	1 : 2
Clover (Alsike)	15·0	3·3	0·6	5·1	4·5	1·5	2·1	0·4	3·6	1 : 2
,, (Crimson)	18·5	2·8	0·7	6·9	6·2	1·9	2·4	0·5	5·2	1 : 3
Lucerne (before flowering)	24·0	4·5	0·8	9·6	6·8	2·3	3·2	0·4	6·3	1 : 2
,, (in full flower) ..	21·0	3·9	0·8	9·3	7·8	2·2	2·7	0·4	5·7	1 : 2
Palm Nut Kernels	91·6	8·4	48·8	26·8	5·8	1·8	8·0	46·5	22·5	1 : 6
Cocoanut Cake Meal ...	88·7	19·5	6·7	42·5	13·6	6·4	15·3	6·5	35·1	1 : 3
Hemp Seed Meal	88·7	34·8	1·7	16·8	25·7	9·3	26·2	1·3	8·9	1 : 0
Palm Nut Kernel Meal (extracted)	90·0	19·0	2·0	49·0	16·0	4·0	17·1	1·9	43·5	1 : 2
Rape Meal (extracted) ...	89·3	36·9	3·1	32·7	9·3	7·3	30·7	2·1	26·2	1 : 1
Sunflower Cake (decorticated)	90·4	37·4	13·8	20·4	12·1	6·7	33·6	12·2	11·6	1 : 1
Sesame Meal (extracted) ...	94·0	46·4	2·4	26·7	7·7	10·8	41·8	2·2	14·9	1 : 1
Apple Pomace (fresh) ...	25·8	1·5	1·1	17·1	4·7	1·4	0·7	0·5	14·9	1 : 1
,, ,, (dried) ...	88·3	4·0	3·5	51·8	27·2	1·8	1·6	1·7	35·5	1 : 2
Maize Malt Culms	86·5	20·7	14·5	39·6	5·8	5·9	17·4	12·4	34·9	1 : 3
Maize Meal (from cornflour)	85·0	9·2	3·8	68·7	1·9	1·4	,,	3·5	65·7	1 : 8
Rice Feeding Meal	87·4	12·0	12·0	45·2	8·0	10·2	6·8	10·2	36·2	1 : 5

Take again a comparison between the grains dari and maize. If the price of dari be £9 per ton and maize £9 10s. 0d. per ton, then the price per unit of maize meal equivalent in dari is £9 divided by 91, which equals, roughly, 2s., whilst the price

per unit of maize at £9 10s. 0d. per ton is about 1s. 11d., and on this basis maize is a cheaper grain for the poultry-keeper to purchase than dari.

General.—Methods of feeding poultry in practice are largely influenced by considerations of economy in labour and by the system of poultry-keeping adopted. Where poultry are kept merely as a subsidiary occupation or in very small numbers merely for the purpose of the family supply, economy in labour is not of such vital importance as it is on a large commercial egg farm, where thousands of birds are kept and reared. In the latter case all superfluous work must be rigidly cut out and the routine of the farm organised in such a way that, with due regard to efficiency, labour is cut down to the absolute minimum.

Again, where the poultry enjoy free range over an ordinary mixed farm and are thus enabled to find a great deal of their own food, the methods of feeding adopted differ considerably from those of the average commercial egg farm, where the birds are more or less permanently confined on limited areas of land.

The conditions under which poultry are kept in this country vary so widely and there is such a large variety of feeding stuffs which can successfully be utilised for poultry, that in an article of this character the subject of feeding can only be treated upon general lines and no definite rules can be laid down as to the best methods of feeding or the best rations to employ.

In the case of backyard poultry-keepers, who wish to use household scraps and surplus material from the garden and allotment, it is impossible to lay down definite rules for the practical application of the foregoing principles, as the quality and quantity of the materials available for use vary so greatly. It should, however, be remembered that meat and fish scraps are rich in proteids and therefore tend to narrow the nutritive ratio, whilst material of a vegetable character will tend to widen it.

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MONTHLY NOTES ON FEEDING STUFFS.

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Feeding Value of Alfalfa Meal.—A correspondent has asked for information on the value of alfalfa meal for poultry, and cows and pigs in winter. Alfalfa is best known in this country as lucerne, and alfalfa meal consists of the dried lucerne plant disintegrated into a meal. Like clover meal it is chiefly used

for poultry kept on an intensive or semi-intensive system, where supplies of green food are scarce or not available. At 18s. 6d. per cwt., the price quoted by the correspondent, the cost per unit starch equivalent works out at no less than 12s. It is, therefore, a very dear feeding stuff, and in the case of pigs and cows it would be more advantageous to feed lucerne hay rather than lucerne meal, if it is desired to feed this material at all. Green lucerne is very useful as a supplement to any rations containing maize or maize meal, since, besides supplying protein it is fairly rich in the ash constituents needed by growing stock.

Use of Cod Liver Oil and Fish Meal.—Recent work carried out at the Rowett Research Institute, Aberdeen, and reported in the Scottish Journal of Agriculture, deals with the value of cod liver oil for feeding purposes, and the connection between fish meal feeding and taint in bacon.

In the poultry tests, feeding tests were carried out concurrently at the three Scottish Colleges of Agriculture, and at the Rowett Institute, the object being to test the influence of cod liver oil on (*a*) growth, (*b*) egg production, and (*c*) hatchability of eggs. The basal ration used was the diet usually fed at each station, and cod liver oil was added in small amounts (usually 1 c.c. per bird).

Growth.—The results of these tests indicate that, with an ordinary commercial diet, there is no material advantage gained in feeding cod liver oil. In the tests in question, the control birds without cod liver oil put on as much weight as those with.

Egg Production.—In these tests, the birds were kept under strictly controlled conditions, and the results obtained showed no evidence of any beneficial effects that could be ascribed to either cod liver oil or linseed oil.

Hatchability.—With regard to this experiment eggs from hens in the egg production experiment were hatched to see whether the cod liver oil or linseed oil had any influence on the hatchability of the eggs. From the data at present available it would appear that the percentage hatchability was not increased by the use of either cod liver oil or linseed oil.

Fish Meal and Taint in Bacon.—Pig feeding experiments were carried out at the Rowett Institute to determine (1) whether fishy taste in bacon was caused by the addition of fish oil to the diet of pigs, and (2) whether the addition of fish oil results in improved health or rate of growth. The space at the writer's disposal does not allow a comprehensive treatment of these

DESCRIPTION.	Price per Qr.		Price per Cwt.	Price per Ton.	Manurial Value per Ton.	Cost of Food Value per Ton.	Starch Equiv. per 100 lb.	Price per Unit Starch Equiv.	Price per lb. Starch Equiv.
	s.	lb.	s.	£ s.	£ s.	£ s.		s.	d.
... British	—	—	11/6	11 10	0 16	10 14	71·6	3/–	1·61
...y. British Feeding	—	—	9/3	9 5	0 12	8 13	71	2/5	1·29
... Danubian ,,	30/–	400	8/6	8 10†	0 12	7 18	71	2/3	1·20
... Persian ,,	27/0	,,	7/7	7 12	0 12	7 0	71	2/–	1·07
... English White	—	—	11/6	11 10	0 14	10 16	59·5	3/8	1·96
,, Black & Grey	—	—	11/2	11 3	0 14	10 9	59·5	3/6	1·87
Scotch White	—	—	12/8	12 13	0 14	11 19	59·5	4/–	2·14
Canadian No. 2 Western	29/3	320	10/3	10 5	0 14	9 11	59·5	3 3	1·74
,, No. 3 ,,	27/9	,,	9/9	9 15	0 14	9 1	59·5	3/1	1·65
,, Feed	27/3	,,	9/6	9 10	0 14	8 16	59·5	2/11	1·56
American	25/6	,,	8/11	8 18†	0 14	8 4	59·5	2/9	1·47
Argentine	24/6	,,	8/7	8 12	0 14	7 18	59·5	2/8	1·43
...n American	41/–	480	9/7	9 12	0 13	8 19	81	2/3	1·20
Argentine	41/3	,,	9/7	9 12	0 13	8 19	81	2/3	1·20
..., Rangoon	—	—	8/3	8 5	1 13	6 12	67	2/–	1·07
...ers' offals—									
Bran, British	—	—	—	6 0	1 8	4 12	45	2/1	1·12
,, Broad	—	—	—	7 0	1 8	5 12	45	2/6	1·34
Fine middlings (Imported)	—	—	—	8 10	1 3	7 7	72	2/1	1·12
Coarse middlings (British)	—	—	—	8 0	1 3	6 17	64	2/2	1·16
...dands (Imported)	—	—	—	6 2	1 8	4 14	60	1/7	0·85
...ley Meal	—	—	—	9 12	0 12	9 0	71	2/6	1·34
...ze ,,	—	—	—	10 5	0 13	9 12	81	2/4	1·25
... Germ Meal	—	—	—	8 12	1 0	7 12	85·3	1/9	0·94
... Gluten-feed	—	—	—	8 15	1 7	7 8	75·6	1/11	1·03
...st Bean Meal	—	—	—	8 0	0 10	7 10	71·4	2/1	1·12
...n Meal	—	—	—	12 7	1 13	10 14	67	3/2	1·70
...h ,,	—	—	—	16 5	4 9	11 16	53	4/5	2·37
...seed	—	—	—	21 0	1 12	19 8	119	3/3	1·74
,, Cake, English (9% oil)	—	—	—	10 10	1 19	8 11	74	2/4	1·25
...conut Cake, English (Egyptian Seed) (5½% oil)	—	—	—	7 5	1 16	5 9	42	2/7	1·38
,, ,, Egyptian (5½% oil)	—	—	—	7 2	1 16	5 6	42	2/6	1·34
...t Cake (6% oil)	—	—	—	8 7	1 11	6 16	73	1/10	0·98
...ae Kernel Cake (6% oil)	—	—	—	5 10*	1 4	4 6	75	1/2	0·62
,, ,, Meal (2% ,,)	—	—	—	4 17	1 5	3 12	71·3	1/–	0·54
...eding Treacle	—	—	—	5 2	0 9	4 13	51	1/10	0·98
...rewers' grains, dried, ale	—	—	—	6 7	1 4	5 3	49	2/1	1·12
,, ,, ,, porter	—	—	—	5 17	1 4	4 13	49	1/11	1·03
,, ,, wet, ale	—	—	—	0 17	0 9	0 8	15	0/6	0·27
,, ,, wet, porter	—	—	—	0 15	0 9	0 6	15	0/5	0·22
...alt Culms	—	—	—	8 0*	1 15	6 5	43	2/11	1·56

* At Liverpool.

NOTE.—The prices quoted above represent the average prices at which actual wholesale transactions have taken place in London, unless otherwise stated, and refer to the price ex mill or store. The prices were current at the end of June and are, as a rule, considerably lower than the prices at local country markets, the difference being due to carriage and dealers' commission. Buyers can, however, easily compare the relative prices of the feeding stuffs on offer at their local market by the method of calculation used in these notes. Thus, suppose coconut cake is offered locally at £10 per ton. Its manurial value is £1 15s. per ton. The food value per ton is therefore £8 5s. per ton. Dividing this figure by 73, the starch equivalent of coconut cake as given in the table, the cost per unit of starch equivalent is 2s. 2d. Dividing this again by 22·4, the number of pounds of starch equivalent in 1 unit, the cost per lb. of starch equivalent is 1·21d. A similar calculation will show the relative cost per lb. of starch equivalent of other feeding stuffs on the same local market. From the results of such calculations a buyer can determine which feeding stuff gives him the best value at the prices quoted on his own market. The manurial value per ton figures are calculated on the basis of the following unit prices:—N, 13s. 1d.; P_2O_5, 4s. 4d.; K_2O, 3s.

tests, but the main facts are as follows:—4 groups of pigs were fed, the main diet being a mixture of maize 10 parts, oats 1 part, sharps 1 part, fish meal 2 parts. In addition, Group 1 received cod liver oil (2 oz. to every 15 lb. of mixed meals); Group 2 herring oil; Group 3 olive oil; Group IV maize. The maize given to Group IV was added in amount sufficient to yield the same starch value as the oils.

The rates of gain in weight of the four lots were uniform, the addition of vitamin A rich cod liver oil, for the period under test, showing no beneficial result.

The amount of oil fed to one pig out of each group was increased towards the end of the test to $1\frac{3}{4}$ oz. per day to intensify any possible tainting effect that might be produced. The bacon from all the pigs was too oily. The bacon from the herring oil group had a markedly offensive fishy taste and was quite uneatable. The cod liver oil group also had a distinct fishy taste. In a previous experiment at the Rowett Institute it was shown that taint was produced from fish meal containing 6·4 per cent. of oil, but not from that containing only 2·3 per cent. of oil. The results of these experiments indicate that the oil in fish meal is the source of taint, and the tendency of fish meals to cause a taint in bacon is in proportion to the percentage of oil present.

FARM VALUES.

CROPS.	Value per Ton on Farm. £ s.	Manurial Value per Ton. £ s.	Food Value per Ton. £ s.	Starch Equivalent per 100 lb.	Value per unit S.E. s. d.	Market Value per lb. S.I. d.
Wheat	8 17	0 16	8 1	71·6	2 3	1·20
Oats	7 8	0 14	6 14	59·5	2 3	1·20
Barley	8 12	0 12	8 0	71·0	2 3	1·20
Potatoes	2 4	0 4	2 0	18·0	2 3	1·20
Swedes	0 18	0 2	0 16	7·0	2 3	1·20
Mangolds	0 17	0 3	0 14	6·0	2 3	1·20
Good Meadow Hay	3 19	0 14	3 5	31·0	2 1	1·12
Good Oat Straw	2 2	0 7	1 15	17·0	2 1	1·12
Good Clover Hay	4 8	1 1	3 7	32·0	2 1	1·12
Vetch and Oat Silage	1 18	0 8	1 10	14·0	2 2	1·16

* * * * * *

PRICES OF ARTIFICIAL MANURES.

NOTE.—Unless otherwise stated, prices are for not less than 2-ton lots f.o.r. in towns named, and are net cash for prompt delivery.

DESCRIPTION	*Average Price per ton during week ending July 11th.*				
	Bristol	Hull	L'pool	L'ndn	Cost per Unit at London
	£ s.	£ s.	£ s.	£ s.	s. d.
Nitrate of Soda (N. 15½ per cent.)	13.10	13.15	13.10	12.17	16. 7
,, ,, Lime (N. 13 per cent.)	...	...	...	12.10	19. 3
Sulphate of Ammonia, ordinary (A. 25¼ per cent.)	13.12*	13.12*	13.12*	13.12*	(N)13. 1
,, ,, ,, neutral (A. 25¾ per cent.)	14.15*	14.15*	14.15*	14.15*	(N)13.11
Kainit (Pot. 12½ per cent.)	...	..	...	1.17	3. 0
,, (Pot. 14 per cent.)	2. 5	2. 1	2.10	2. 5	3. 3
Muriate of Potash (Pot. 50 per cent.) ...	9.10	7.10	8. 0	7.15	3. 1
Sulphate of Potash (Pot. 48 per cent.) ...	...	12.15‡	11.15	11. 0	4. 7
Basic Slag (T.P. 35 per cent.)	...	...	...	3.12§	2. 1
,, ,, (T.P. 30 per cent.)	...	...	...	3. 0§	2. 0
,, ,, (T.P. 26 per cent.)	2.13§	2.10§	...	...	...
,, ,, (T.P. 24 per cent.)	2. 9§	2. 6§	2. 7§	...	...
,, ,, (T.P. 20-22 per cent.)	...	2. 3§	..	2. 7§	2. 4
,, ,, (T.P. 18 per cent.)	2. 3§	...	2. 0§	...	...
Superphosphate (S.P. 35 per cent.) ...	4. 7	...	4. 5§	3.15	2. 2
,, (S.P. 30 per cent.) ...	3.17	3. 5	3.15§	3. 7	2. 3
Bone Meal (T.P. 45 per cent.)	9.10	9.10†	9. 0	8. 7	...
Steamed Bone Flour (T.P. 60 per cent.) ...	8.10†	7. 2†	7. 0	6.10	...
Fish Guano (A. 9-10, T.P. 16-20 per cent.)...	12.15	...	12. 5	13.12	...

Abbreviations: N.=Nitrogen; A.=Ammonia; S.P.=Soluble Phosphate; T.P.=Total Phosphate; Pot.=Potash.

* Delivered in 4-ton lots at purchaser's nearest railway station.

† Delivered (within a limited area) at purchaser's nearest railway station.

‡ At Goole.

§ Prices include cost of carriage from works to town named. Hull prices include delivery to any station in Lincolnshire or Yorkshire: London prices include delivery within a limited area. Cost to purchasers in other districts will be greater or less according to the distance of different purchasers from the works.

* * * * * *

Shipment of Live Stock to New Zealand.

THE New Zealand Government have notified the Ministry that the shipment of cattle, sheep and pigs from this country to the Dominions will in future be subject to the following conditions:—

(1) For one month from the date of an outbreak of Foot-and-Mouth Disease no shipments may be made: provided, however, that an outbreak in one country shall not be held to prohibit shipments from the others—*e.g.*, an outbreak in England will not prevent shipments of cattle, etc., from Scotland or Ireland.

(2) After one month from the date of the last outbreak, cattle, sheep or pigs may be shipped at London, Liverpool or Glasgow to New Zealand from any part of the country, provided that, until three months have elapsed from the date of an outbreak, no shipment shall be made of cattle, sheep or pigs

which have been, since the date of that outbreak, within a radius of 15 miles round the seat of the outbreak.

(3) Provided that special authority may be given to permit shipment of cattle, sheep or pigs from approved areas after segregation in approved premises at the port of loading for 14 days, provided that during that period outbreaks of Foot-and-Mouth Disease had not occurred at the port of segregation nor in the areas from which any of the animals originated, or had become epidemic in character.

(4) The fodder accompanying the animals must be the product of a county where no Foot-and-Mouth Disease has existed for six months prior to date of shipment, and must be sent *direct* from such county to the ship's side, accompanied by a statutory declaration from the supplier as to its origin.

It will be necessary for the New Zealand Government Veterinary Officer (New Zealand Government Offices, 415, Strand, London, W.C.2.) to be personally satisfied as to origin of any fodder shipped, and approval must be obtained in each case before definite arrangements are made as to purchase.

The above also applies to fodder accompanying horses.

(5) No fodder will be allowed to be landed in New Zealand.

(6) The usual owner's declaration and Veterinary Certificates must be furnished.

* * * * * *

Damage by Marking of Sheep.

THE Ministry desires to draw the attention of farmers and flock owners to the damage which is caused to the wool and skin of sheep by careless pitch-branding. From information which the Ministry has received, it is very evident that considerable damage and loss are annually incurred from this cause, and an examination of pelts shows that in many cases the branding iron has inflicted a wound which has so marked the skin that the dressed pelt is useless for any good class of trade. The consequent serious loss could easily be obviated if branding were carefully done. Neither branding iron nor pitch should be so hot as to burn the skin, but just hot enough to leave a clean neat mark. Burning is especially apt to occur if branding is done at clipping time or too soon after clipping, and farmers should therefore be careful not to perform clipping and branding at the same time. The best time to brand sheep is a week or two after clipping, when the wool has grown a little.

There is reason to believe that hill sheep are more liable to be damaged by pitch branding than the better conditioned sheep of the lowlands, but if sufficient care is not taken lowland sheep will be damaged no less than the others. An investigation is being made with a view to finding some satisfactory alternative method of marking sheep. The difficulty in the past has been that while pitch or tar branding is liable to spoil both the wool

and the pelt, alternative preparations have proved to be non-permanent or to be otherwise unserviceable.

* * * * * *

The World's Dairy Congress.

IT is expected by the World's Dairy Congress Committee for England and Wales that about 30 persons from this country will form the English delegation to the World's Dairy Congress to be held at Washington on 2nd and 3rd October, at Philadelphia on 4th October, and at Syracuse on 5th-10th October next.

The opportunity will be taken by some members of the delegation of visiting places of general interest in the United States. At Washington, the delegates will have an opportunity of inspecting the Government's laboratories and experimental stations, &c. At Syracuse, the National Dairy Exposition will be held at the same time as the Congress and complete exhibits in connection with various branches of the milk industry in the United States and Canada, from dairy cattle to the latest machinery for the manufacture of dairy products, will be on view. There will be an international dinner on the evening of 10th October, at which it is expected representative dairy scientists and industrial leaders from all parts of the world will be assembled. Any further information can be obtained from the Secretary of the Committee for England and Wales at the offices of the Ministry of Agriculture, 10, Whitehall Place, S.W.1.

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Report of the Experimental and Research Station, Cheshunt.

THE high form of intensive cultivation practised by glasshouse growers has problems of its own which are not easily dealt with at any of the ordinary Agricultural Research Stations, and the industry was particularly fortunate in being able to set up a special station at Cheshunt to investigate problems associated with glasshouse crops.

The Station has made very considerable progress, and its Eighth Annual Report (1922) contains much valuable information relating to the tomato and cucumber crops and their diseases. The Director has given some interesting notes on "Mosaic Disease," which, though commonly associated with potatoes, yet, nevertheless, attacks other plants, including tomatoes and cucumbers. The experiments on this disease recorded in the report are a valuable addition to our knowledge of the subject.

The Station has received a special grant from the Ministry to study the effect of charging the atmosphere in which the plants are growing with large amounts of carbon dioxide gas, and the report gives an account of the preliminary investigation that has been made. This is a particularly important problem which has been arousing much interest in the industry.

Certain pests, like wood-lice and red spider are ever troublesome to glasshouse crops, and growers will therefore welcome the recommendations for their control made by the Station Entomologist.

Generally, the report is an extremely helpful and important contribution to literature on glasshouse cultivation; and the logical way in which the recommendations have been drawn from the results of experiments will be convincing to the practical grower.

* * * * * *

Poultry Research.

THE Ministry has received the approval of the Treasury and the Development Commission to a total capital expenditure of £4,850 on a scheme for assisting scientific research in poultry breeding, nutrition, and disease. The breeding and nutrition research work under the scheme will be carried on at the Cambridge School of Agriculture, and the disease research work at the Ministry of Agriculture's Veterinary Laboratory at New Haw, Weybridge. One-fourth of the total capital expenditure will be contributed by the poultry industry itself, and this amount will be collected by the National Poultry Council. The remaining three-fourths will be a grant from the Development Fund out of the moneys provided for agricultural development and research under the Corn Production Acts (Repeal) Act, 1921. The entire cost of maintenance will be provided out of the same fund until 31st March, 1927.

The Scheme also provides for poultry educational work and commercial experiments at Harper Adams Agricultural College, Newport, Salop, for practical breeding experiments for egg-production at a centre in the North of England, and for experiments in breeding for table poultry production at a centre in the South of England. Arrangements are, however, not yet complete for a beginning to be made on these three subsidiary parts of the scheme.

* * * * * *

Experiments in the Preservation of Eggs.

EXPERIMENTS in the preservation of eggs were carried out in the Poultry Department of Cornell University, U.S.A., in 1916-1918, and the results are described in the Journal of the American Association of Instructors and Investigators in Poultry Husbandry for June, 1919.

The treatments tried were:—dipping in hot water for six seconds, dipping in boiling water for six seconds, coating with vaseline, coating with paraffin wax and with a mixture consisting of five parts vaseline to two parts paraffin wax, and preserving in solutions of sodium compounds. After treatment some of the eggs were kept under cellar conditions and some in cold storage.

One very striking fact brought out was that paraffin wax apparently had a detrimental effect on the eggs which were treated with it. One lot of eggs was dipped in melted paraffin wax so that each egg was entirely coated. Half of these eggs were placed in cold storage and the other half kept under cellar conditions. When these eggs were examined it was found that all of them were rotten. It would seem, therefore, that coating with paraffin wax is worse than useless since the cold storage eggs which were not treated at all were mostly fit to eat. One lot of eggs was then coated with a mixture of vaseline and paraffin wax in the proportion of five to two, and half the eggs were placed in cold storage and the rest kept under cellar conditions. Of the eighty eggs kept under cellar conditions all but twelve were rotten, and these twelve were not fit to eat. Of the eggs kept in cold storage only 9.1 per cent. were fit for use, the balance being either sour or musty, although their candled appearance was fairly good. Another lot of eggs was treated with vaseline alone, and kept in cold storage for fifteen days longer than the lot just mentioned. These kept in much better condition, only 2.6 per cent. being unfit for consumption as against 90.8 of the former lot. This seems to show that paraffin wax promotes decay in eggs which are stored for long periods.

Treatment of eggs with oil or vaseline apparently improves the keeping quality. Eggs were dipped in hot oil for six seconds and then placed in cold storage, while others were coated with vaseline and placed in cold storage. Both of these were much better than the untreated cold storage eggs. Some of the eggs which were treated with hot oil were kept under cellar conditions and only 8.7 per cent. were found to be unfit for use, where untreated eggs would no doubt have been either entirely dried

up or rotten. The chief objection to the use of oil or vaseline is that the appearance of the egg is spoiled by the glassy look. Dipping in hot water instead of hot oil is quite satisfactory except that the air cells are nearly as large as in untreated cold storage eggs and are more apt to be broken than in the case of the oil-treated eggs. So far as the quality of the eggs is concerned there is very little difference between the two methods of treatment.

Another interesting fact which was brought out is that sealing eggs in fruit jars is a poor method of preservation. A number of eggs treated with hot oil and some which had been immersed in hot water were sealed in glass fruit jars and part kept in the cellar and part in a room which was much colder than an ordinary cellar. When examined at the end of nine months, all of these eggs were rotten.

Another section of the trials dealt with the use of solutions containing sodium, in order to test a theory that the sodium in the water-glass used for home preservation is the chief cause of its preservative effect and therefore any sodium compound would do as well as water-glass. Acting on this suggestion, the following compounds containing sodium were tried:—ordinary hard soap, sodium carbonate and sodium benzene sulphanate. Sodium salicylate was also considered, but was found to be too expensive to be practical. The solutions were made up so that they contained practically the same amount of sodium as the water-glass solution. The results obtained were that eggs preserved in the soap solution were fully as good as those preserved in water-glass, while those in the sodium carbonate and sodium benzene sulphanate were all spoiled. The reason for this difference appeared to be that in the case of the soap solution a coating of what was judged to be a calcium soap had formed on the shell of the eggs. Moreover, the solution had thickened in a manner similar to the thickening of the water-glass solution, so that none of the solution had entered the egg. On the other hand, both of the other solutions remained watery and in both cases the solutions had entered the eggs and spoiled them for eating. Moreover, in the case of the sodium benzene sulphanate no germicidal effect was observed, but on the contrary bacteria appeared to be encouraged by it.

So far as the experiments have been carried, therefore, the results are chiefly negative, but two interesting effects have been noticed. The first is that paraffin wax for some reason has a bad effect upon eggs. The second is that apparently it

is not the sodium in water-glass which alone has the preservative effect: it is rather the combination of the silica, stopping up the pores, and the sodium, preventing the growth of bacteria in the solution, which keeps the eggs fit to eat.

* * * * * *

AGRICULTURE ABROAD.

Agricultural Education in Queensland.

An interesting Act providing for Agricultural Education has recently been passed by the Federal Parliament of Queensland, the objects of which are to fit boys to follow agricultural pursuits, to train girls in domestic science, and to enable the more advanced students to take degrees and diplomas in agriculture. The Act provides for the setting up of a temporary Board of Agricultural Education, whose chief functions are to advise as to the allocation of moneys voted by Parliament for the purpose of agricultural education, to investigate and report on the establishment and administration of agricultural schools and classes, and to issue bulletins dealing with agricultural education and cognate subjects. At a later date the Board may be superseded and its functions discharged by a Superintendent of Agricultural Education appointed by the Governor in Council.

Upon the recommendation of the Board of Agricultural Education, the Governor in Council may establish whole or part-time agricultural schools, day or evening classes, and hostels for the accommodation of the students. In addition, "any society, association, or body of persons" may make application for the establishment of an agricultural school or agricultural classes in a particular locality, and, providing *inter alia* the applicants can produce satisfactory evidence that they have already raised a sum of money equal at least to one-third of the estimated capital expenditure, the Governor in Council may, on the recommendation of the Board, establish such schools or classes, and may contribute the balance of the sum required. The whole annual cost, upkeep and maintenance of these schools or classes will be defrayed out of State funds. The schools and classes are to be subject to State supervision and inspection, the Committees of Management being constituted and appointed in such manner as the Governor in Council may approve, after consultation with the Board. The agricultural education so provided is, with few exceptions, to be free.

Provision is also made in the Act for the contribution of a sum, not exceeding two-thirds of the capital cost, towards providing an agricultural section or agricultural classes in State-aided Grammar Schools and Technical Colleges.

* * * * * *

Importation of Pure-bred Live Stock into the United States.

THE new Customs Tariff of the United States of America, which came into force on 22nd September, 1922, provides that any animal imported by a citizen of the United States specially for breeding purposes shall be admitted free, provided that it is pure bred, of a recognised breed, and duly registered in a book of record recognised by the U.S. Secretary of Agriculture for that breed. Otherwise, the duties on live stock are as follows:—cattle weighing less than 1,050 lb., 1½ cents per lb.; weighing 1,050 lb. or more, 2 cents per lb.; sheep and goats, 2 dollars per head; swine, ½ cent per lb.

The U.S. Department of Agriculture has now issued regulations (B.A.I. Order No. 278) laying down the procedure that must be followed to secure duty-free importation:—

Under these regulations the Bureau of Animal Industry is authorised to issue certificates of pure breeding. To obtain these certificates importers have to apply to the Bureau in a prescribed form giving particulars as to the animals to be imported. With the application certificates of registration and pedigree, issued by the custodian of one of the books of record referred to below, are to be furnished to the Bureau with an affidavit from the owner, agent or importer that the animals so imported are the identical animals described in the certificates of record and pedigree.

The Bureau also requires with the application a certificate from the seller or his agent giving the breed, sex, name, and registry number of each animal sold to the importer, the date of sale, the place of purchase, and the name and address (in the United States) of the purchaser.

If the application is found satisfactory certificates to that effect will be issued and forwarded to the Collector of Customs at the port of entry. Certificates of pure breeding will not, however, be issued until the description of the animals taken by an inspector of the Bureau of Animal Industry at the port of entry is received at the Department at Washington.

The Order contains a list of recognised breeds and books of record across the seas. The names of the following British breeds, with the name of the Society publishing the book of record, are included in the list:—

Cattle.—Aberdeen-Angus, Ayrshire, Devon, Galloway, Guernsey, Hereford, Highland, Jersey, Kerry and Dexter, Red Poll, Shorthorn, Sussex, Welsh.

Sheep.—Cheviot, Cotswold, Dorset Horn, Hampshire Down, Kent or Romney Marsh, Kerry Hill, Leicester, Border Leicester, Lincoln, Oxford Down, Shropshire, Southdown, Suffolk, and Wensleydale.

Horses.—Clydesdale, Hackney, Shetland Pony, Shire, Suffolk, Thoroughbred, Welsh Pony, and Cob.

Pigs.—Berkshire, Large White (Large Yorkshire), Tamworth.

Before any additional breed can be added to this list the custodian of its book of record must submit to the Department a complete set of the published volumes of such book of record together with all rules affecting the registration of animals. The Department will then consider the case on its merits.

Communications should be addressed to *The Chief of the Bureau of Animal Industry, Department of Agriculture, Washington, D.C.*

* * * * * *

Work of the Lithuanian Ministry of Agriculture.

ONE of the most active of the Lithuanian Ministries is the Ministry of Agriculture, as is appropriate in a country where the majority of the inhabitants are engaged in agriculture. Its programme includes agricultural education, the training of teachers to give agricultural instruction to pupils in elementary schools, improvement of live stock, and the encouragement of associations of agriculturists for the purpose of improving Lithuanian agriculture and marketing its products.

The Ministry has founded agricultural courses in many districts and, in order to reach the more remote regions, travelling lecturers are largely employed. The teaching is free to all and lasts three months. In conjunction with the municipalities the Ministry is establishing district grain cleaning stations and measures are being taken for the improvement of live stock. For the latter purpose 90 Middle White, Large White, and Berkshire boars have been bought in England at an average of £17, and a large quantity of Orpington eggs has been imported for sale to poultry-keepers. Among other associations which are aided by the Government, the Shavli Union combines all the district agricultural associations of the northern portion of Lithuania, and is arranging the export of agricultural produce to England.

* * * * * *

Farm Labour in Belgium.

AT a recent meeting of the Belgian Central Chamber of Agriculture, M. Rasquin gave an address* on the depletion of agricultural labour. He indicated that the question was not a new one in Belgium, but that since the War and especially during last year, the dearth of workers had become a serious menace to the agricultural industry.

* Published in the March, 1923, issue of the *Journal de la Société Centrale d'Agriculture de Belgique.*

In the polder regions workers crossed the borders into Holland to receive the benefit of increased wages due to the rate of exchange, while in the more urban areas they willingly abandoned the fields for the local factories. In the communes contiguous to railway stations considerable numbers of workers, attracted by increased wages, travelled daily or weekly to the French industrial centres, and so neglected the Belgian countryside. In December over 40,000 labourers travelled to France each week, and of these it is estimated that one-fifth were agricultural workers. During the previous May the exodus increased to 120,000 against 60,000 for the corresponding month before the War.

Although it seemed clear that the better wages and shorter hours of industrial pursuits were the principal causes of the desertion of the farms, the attractions of town pleasures were also held to be a strong contributory cause. The fascination of cinemas in the cities was regarded as being such an important factor in attracting workers from the countryside that France had voted 500,000 francs for the organisation of cinema shows in rural areas. Workers were also introduced to town life through the demands of military service and frequently decided to settle in garrison towns rather than tolerate the inconveniences of separation from their families. The exodus from the countryside was also greatly encouraged by the extensive issue of cheap weekly tickets by the Belgian railways.

As regards possible remedies M. Rasquin proposed that the system of giving bonuses on production might be extended so that agricultural workers would be rewarded for increased production or for reducing labour in any way. The worker should be given every facility for producing his own food, and by working on his own account he would become a collaborator with his employer. The questions of accommodation and housing needed thorough attention. It was suggested further that family allowances should be given after a stay of six months on a farm at the rate of 10 francs per child per month up to a maximum of 40 francs. This system of allowances was already established in the province of Liége and operated in a fairly satisfactory manner.

Above all, the speaker held that every facility should be extended to enable the worker to become a proprietor by offering advances for the purchase of small holdings and by minor concessions such as exemption from stamp duty and registration.

From the agricultural point of view labour exchanges had

proved ineffective as they were located in the big cities, and the only remedy lay in their being subsidised by the Belgian Ministry of Agriculture and set up in the centres of agricultural districts.

It was pointed out that there appeared to be no serious obstacle to following the lead of France and importing Polish labour during the busy seasons. Reports indicated that Polish workers in general gave satisfaction, but it was considered advisable to return imported workers to their own country as soon as the seasonal work was completed, as otherwise there was a risk of their becoming a charge on public relief funds.

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International Congress and Exhibition of Social Economy at Buenos Aires.

An International Congress and Exhibition of Social Economy will be held at Buenos Aires in Sept., 1924, under the auspices of the "Museo Social Argentino," an unofficial institution in friendly relations with the Argentine Government. The Congress will deal, *inter alia*, with agricultural questions, *e.g.*, comparison of the importance of agriculture and commerce and industry in various countries, organisation of agricultural credit and of international commerce in agricultural produce, etc.

Besides delegates representing national or municipal authorities anyone interested can, on payment of a fee, attend the Congress.

A copy of the preliminary programme can be seen at the Office of the Ministry of Agriculture and Fisheries, 10, Whitehall Place, S.W.1. Inquiries should be addressed to the "Museo Social Argentino," Maipú 126, Buenos Aires, Argentine Republic.

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QUESTIONS IN PARLIAMENT.

Grubbing of Hops.—Sir A. Holbrook asked the Minister of Agriculture, in the House of Commons on the 4th July, whether he has received any request from hop growers in the country to cancel the proposed restriction of the 1923 hop crop; whether his attention has been called to the injury which would be inflicted by such restriction on a large number of growers whose whole capital is invested in the industry, as well as upon many branches of labour and trade associated therewith; and whether he will consider the desirability of cancelling the order for restriction?

Sir R. Sanders replied:—"I am aware that the call to restrict the 1923 hop crop has been very unwelcome to many hop growers who have been replanting the acreage which had been compulsorily grubbed in 1917, but I think that most growers recognise that no other course was possible, on consideration of

the fact that the consumption of beer has fallen far below that which was anticipated by those in closest touch with the trade. As I have already explained, should an average crop be produced and picked on the acreage under hops which obtained at the beginning of the year, a very large surplus over requirements would result. The Hop Controller would be unable to take this surplus from growers as he would have no prospect of selling it. Growers were therefore advised of the situation in January last in a notice issued from the Ministry, and they were recommended to arrange to restrict their production in the coming season. It was suggested that this might be undertaken this year as a temporary measure by a careful overhauling of the gardens, weeding out old and worn out plants, etc., and without resorting to permanent grubbing, until the position of the hop industry, which ultimately depends on the consumption of beer, could be more clearly foreseen. The answer to the last part of the question is therefore in the negative."

Entertainments Tax on Agricultural Shows.—In reply to a question asked by Mr. Lamb in the House of Commons on the 4th July, the Financial Secretary to the Treasury said that, under the clause which was added to the Finance Bill on the 2nd July, exemption from Entertainments Duty may be granted in respect of agricultural shows which, *inter alia*, consist solely of an exhibition of the products of agriculture, or of materials, machinery, appliances or foodstuffs used in the production of those products, or displays of skill by agricultural workers in work pertaining to agriculture, together with a band. Where an agricultural show includes exhibits outside those mentioned, the question whether exemption from Entertainments Duty can be granted depends upon whether such exhibits, if forming a separate exhibition, could have been exempted under any other provision of the law.

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Foot-and-Mouth Disease.—A further outbreak occurred at Skelling on 29th June, the premises involved adjoining those on which the original outbreak of disease occurred on 20th June. The restrictions in this district have been relaxed from time to time, and are now applicable only to a small area immediately surrounding the infected premises.

Bedfordshire.—On 3rd July, a fresh centre of disease appeared amongst pigs, on premises at Stevington, some four miles from Bedford. The usual restrictions were applied in connection with this outbreak. Ten further outbreaks have since been confirmed on premises within a few miles of the first.

Hampshire.—On 25th July a new outbreak appeared at Alton, Hants. Further particulars will be given in next month's *Journal*.

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REPLIES TO CORRESPONDENTS.

Manurial Value of Feeding Stuffs.—C. V. asks why the manurial value of P_2O_5 in the note to the table on p. 167 of the *Journal* for May is charged at 4s. 6d. per unit, whereas on p. 169 the unit price of soluble phosphate is given as 2s. 3d.

Reply: The unit price in the footnote on p. 167 is for phosphoric acid (P_2O_5). The unit prices on p. 169 are for total phosphates (as tricalcic phosphate). The unit price of insoluble phosphates is usually calculated (as

explained at the top of p. 11 of Leaflet No. 72) from the price per ton of steamed bone flour, after making allowance for 1 per cent. of nitrogen. Thus £6 17s.–15s. 5d.=£6 1s. 7d. This divided by 60 gives approximately 2s. 0¼d. per unit tricalcic phosphate and, multiplying 2s. 0¼d. by 2·2 (see the rules for conversion on p. 3 of the leaflet) approximately 4s. 6d. per unit P_2O_5.

Red Spider.—E.M.G. asks whether Cox's Orange Pippin apple trees infested with Red Spider (specimens sent) are likely to be seriously damaged. Also for treatment to be applied.

Reply: The Red Spider you enclose appears to be the usual species (*Tetranychus pilosus*) found upon apples when growing in the open. It is seldom that this mite causes any serious damage, and although traces of their attack on the buds and leaves you send can be seen, judging from the small amount of material they could hardly be regarded as responsible for the major part of the injury.

There are signs of considerable caterpillar attack, Apple Blossom Weevil appears also to be present, and also Apple Sucker, while the margins of the young leaves are somewhat suggestive of weather injury. The orchard should therefore be examined rather carefully before you finally decide that the Red Spider is the pest to be tackled. If you come to this conclusion, then you might try one of the Red Spider washes indicated in the enclosed leaflet, or you might care to try the following, which appears to have been found exceptionally effective against this particular mite in the U.S.A.—Lime-sulphur in water, 1 per cent., with the addition of 6 lb. sulphur paste and 1 lb. resin fish-oil soap to each 100 gallons. The latter could with advantage be replaced by any good brand of potash soft soap.

Wheat Bulb Fly.—H.P. asked in April for the name of maggots found in the stems of wheat which was being destroyed and the remedy; also if rolling would be of service.

Reply: The wheat sent was found to be severely attacked by the Wheat Bulb Fly. The grubs were in all cases practically full grown, and if the sample was representative of the field, little further spread of the attack should take place.

Under these circumstances rolling would certainly be of value, but no further treatment was suggested. Wheat which had already escaped was not likely to become attacked, and it was only necessary to decide as to whether a sufficient plant was left on the field. If this was not the case, barley, which would not be attacked by the fly, could be sown, and a mixed crop taken.

In general, attacks by the Wheat Bulb Fly are found to be worse on land which has been fallowed or has been thinly covered by a crop during the latter half of the preceding summer.

In regard to treatment, apart from avoiding the sowing of wheat on land sown during July and August, the only measure which can be taken is to watch the wheat crops carefully so as to detect an attack in the early stage. An application of such a dressing as nitrate of soda will then be of value in assisting the crop to grow away from the attack, but it is of course necessary to detect the presence of the pest at an early stage.

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